Developing and trialling new more resource efficient product offerings

Flexible Aluminium Containing Laminate Packaging Collection Trials Summary Report

March 2016
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Anthesis Consulting Group

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Executive summary

ES1.1 Project aims and objectives

The aim of the Flexible Aluminium-Containing Laminate Packaging Collection Trials was to undertake an active research project to understand the potential to develop and trial new post-consumer recycling programmes for flexible packaging items such as food/beverage pouches, toothpaste tubes, pet food sachets. The trials and this report focus on aluminium-containing laminate packaging only and not on similar flexible packaging solutions that do not contain aluminium.

ES1.2 Background

There are approximately 160,000 tonnes per annum of aluminium-containing flexible packaging in the UK marketplace. There is the potential for this to generate around 16,000 tonnes per annum of additional aluminium into the secondary commodity market if captured for recycling. Flexible packaging is becoming increasingly widespread and the global market is estimated to have a Compound Annual Growth Rate of 5.1% from 2013 to 2018\(^1\). Virgin aluminium, extracted from bauxite, has one of the highest environmental footprints of mined materials. This means that recycling of flexible packaging could make an important contribution towards reducing the environmental footprint of aluminium products as well as contribute to increasing UK recycling rates.

ES1.3 Project Partners

The project was supported by Coca Cola Enterprises, Enval, Nestlé UK, SUEZ UK\(^2\), Tesco UK and project managed by Anthesis UK Ltd.

ES2.1 Trial Operations

Local authority areas for the trial were identified by SUEZ UK. The objective was to seek to identify three different geographies which operated different collection methods and had different demographics in order to assess how well collection schemes might perform in each. The trial areas and schemes agreed were:

- Calderdale Council: Sowerby Bridge, 259 households;

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\(^1\) Flexible Packaging Market by End-Use (Food, Beverage, Personal Care & Pharmaceutical), Material (Polypropylene, BOPP, CPP, Polyethylene, EVOH, PA, BOPET, PVC, Aluminium, Paper, Cellulosic) - Global Trends & Forecast to 2018 Published by Markets and Markets in Nov 2013.

\(^2\) In the course of this project SUEZ UK underwent a brand rationalisation exercise; therefore a number of the materials presented in this document use the SITA name and branding that were current at that time.
- Hounslow Council: selected areas within Chiswick Riverside, Hounslow West, Syon, Heston West and Feltham West, 187 households;
- Bracknell Forest Council: Warfield and Bulbrook, 202 households in each area;

Each participating household was provided with a standard silver/grey 7 litre food waste type caddy and an initial roll of 50 orange coloured polythene liners with ‘Recycling Trial’ printed on each bag.

**ES2.2 Trial approaches in each area**

The trial in Calderdale used an ‘opt-out’ approach to recruiting residents to participate in the new recycling scheme. This approach was chosen in order to contrast it to the ‘opt-in’ approaches used in Bracknell Forest and The London Borough of Hounslow.

**ES2.3 Material sorting**

All collected material was transferred to SUEZ’s Mitcham facility for sorting, analysis and decontamination. Following the analysis undertaken at SUEZ’s Mitcham site, the flexible packaging was packaged and transferred to Enval’s site in Alconbury for processing.

**ES3.1 Communications**

The communications development and delivery was considered to be a key part of the project, and the impact of the materials on householder behaviour change would be crucial to the participation and levels of contamination during the trial. To this end, getting the communications right was a key part of the development of the project and the partners used their collective behaviour change, marketing and communications expertise to maximise impacts. Communications were developed in discussion with the partners and tested through a resident focus group in Bracknell Forest before production.

**ES4.1 Material processing**

Post-sorting, all material was transferred to Enval’s Alconbury facility for processing and detailed analysis. Visual examination showed samples to be generally relatively clean and quantitatively, the level of contamination remained the same over the whole trial and was very similar for the three areas. Contamination observed at Enval was additional to that already removed during the material sorting process carried out by SUEZ at Mitcham. The Enval process enables the separation of aluminium from the packaging and the production of a fuel oil from the plastic element.
ES5.1 Trial Outcomes

During the initial mobilisation phase the partners took a joint decision not to go ahead with the bring site collection element of the trial. All other aspects progressed well, and a nine month collection trial was initiated in February 2015.

ES5.2 Socio-demographic differences

The demographic differences between the three trial areas were driven by the differing populations themselves. The ethnic mix of the population (based on participants in the end of trial survey) was extremely limited in both Bracknell Forest and Calderdale with the participants broadly classifying themselves as ‘White British’ in both areas. This was very different in Hounslow which provided a much wider ethnic mix; 45% of the population classifying themselves within one of 19 alternative descriptions of ethnic background. In Hounslow, from a messaging and communications perspective, this mix of ethnic background is reflected in that c. 30% of the population do not speak English. In comparison, only 7% of Bracknell Forest residents and 5% of Calderdale residents are not English speakers. Streets with a predominance of flats were avoided; the trial constituted mainly detached, semi-detached and terraced properties. However, due to the characteristics of the location there was a significantly higher proportion of terraced and semi-detached houses in Hounslow compared to Bracknell Forest, and to a lesser extent than Calderdale.

ES5.3 Participation during the trial

Over the lifetime of the trial, there was a gradual decrease in participation by residents across all areas. For some residents participation was simply affected by the low incidence of relevant material. Participation data analysed from Bracknell Forest showed that, although 12% of residents took advantage on average of the fortnightly frequency of the service, the majority used the service less frequently with nearly 60% using the service only once every 4 collections (i.e. 8 weekly) or less (excluding those who did not participate at all).

The highest volume use of the trial was for pet (principally cat) food pouches. Lack of material was the predominant reason given by residents for not participating. The highest frequency use by residents was for toothpaste tubes.

ES5.4 Material recognition

Analysis of material at the SUEZ Materials Recovery Facility (MRF) in Mitcham provided data on both the quantity of contamination and the type of materials that were incorrectly

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3 Data from 2011 Census
placed in the container. The predominant non-target materials collected throughout the trial were: crisp packets and similar plastic films such as biscuits and chocolate wrappers; non-target cosmetic bottles and tubes – i.e. not containing aluminium; food/drinks pouches not containing aluminium; aluminium foil; medicine blister packs. Across the trial percentage contamination was on average 29% and as high as 38% on average for the Calderdale samples. This contamination does not include contamination from product remaining within the packaging.

**ES5.5 Transfer of materials**

One of the greatest challenges faced in the operation of the trial was in regard to the transfer of material between the council areas and Mitcham and onwards from Mitcham to Enval’s processing facility. The principal problems with the transfer operation were: the small quantities of material being shipped (becoming simply a cost/unit weight issue with the transfer) and the offensive nature of the waste – with the predominance of pet food pouches being a primary contributor in terms of odour.

**ES5.6 Material sorting**

Material sorting is one area that would need to be better developed in order for a commercial scale scheme to be considered. The approach used for the trial was 100% manual sorting, which for a large quantity of material would not be cost effective. Based on trials carried out by WRAP, existing eddy current separation techniques would be able to separate laminated materials on a commercial scale and would even be effective for toothpaste tubes, which, based on Enval’s data, would have one of the highest contamination rates (based on residual content weight to packaging ratio) of the materials targeted.

**ES5.7 Processing**

Material processing at Enval has operated in line with expectations and with the quality both of aluminium and oils consistent throughout the trials and suitable for end market requirements. The process has managed the levels of contamination found in the material i.e. post manual sorting and resulting from residual product such as cat food, toothpaste etc. remaining in the packaging.

From the trials carried out in this project, the metal yield of the aluminium obtained varied between 57% and 66%. Again, this is consistent with the metal obtained with pre-consumer, clean waste, demonstrating that the presence of residual food and other contamination in post-consumer waste did not affect the quality of the metal recovered. At this value of metal yield and at today’s prices, the metal obtained from the process could have a value of approximately £630 / tonne. However, it is important to note that this value will always depend on the value of aluminium in the London Metal Exchange (LME).
Less than a year ago the value of the aluminium with the same metal yield would have been approximately £800 / tonne and before the 2008 economic crisis, £1,370 / tonne.

The value of the oils, again this will always depend on the price of crude oil which affects the value of other products such as red diesel and heavy fuel oil (HFO) which the oils from the Enval process can be used as substitutes for in heating applications. From the analysis done and although the amounts produced were not enough to be sold, Enval has established that in current market conditions and considering that at the time of writing the price of crude oil is at its lowest level of the last 15 years, the oils could in principle be sold at a price of approximately £45 per tonne.

**ES5.8 Economic evaluation**

The results of the trial have enabled the project partners to prepare an outline estimate of the potential economic impacts of a UK-wide collection of aluminium containing flexible packaging. Data used for the calculation was provided by SUEZ and Enval and has been based both on the outcomes of the trial, experience elsewhere and on hypothetical scenarios, assumptions or estimates where data does not exist. Estimates have been made based on two different scenarios but with the same collection system (the assumption of underbody boxes added to existing RCVs). The resulting economics are indicative only, as they are based on a limited sample size, but have been provided in this report to demonstrate the potential costs and contribution to recycling rates of kerbside aluminium containing flexible packaging recycling schemes.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Participation Rate</th>
<th>Collected Volume</th>
<th>Estimated Total Cost</th>
<th>Estimated Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 1: a participation rate of 80% and the per household collected volume of 3.13kg per year.</td>
<td>~80%</td>
<td>~3.13kg/year</td>
<td>~£41</td>
<td>~0.24%</td>
</tr>
<tr>
<td>Scenario 2: a participation rate of 30% and a per household collected volume of 3.13kg per year which also generates additional requirements for collection crew time and costs of transport to the local transfer station.</td>
<td>~30%</td>
<td>~3.13kg/year</td>
<td>~£68</td>
<td>~0.09%</td>
</tr>
</tbody>
</table>

Estimated costs and revenue generation for reprocessing suggest:

- Operating cost: ~£5 per tonne.
- Gross profit per tonne: ~£84

**ES6.1 Key Conclusions and Recommendations**

The following key conclusions are made based on the data collected during the trial:

- There are issues with the public identifying the correct materials to recycle.
• Arisings of flexible laminated packaging material vary considerably from household to household with many considering that the quantity they produce is either too small or too infrequent to warrant collection. Other householders (particularly those with pets) may produce significant and regular quantities.

• Capture rates are likely to reflect the fact that some pet food pouches may enter the residual stream because of ‘yuk’ factor considerations, some cosmetic and toothpaste tubes arising in the bathroom may not be put in recycling containers and some baby food and drinks pouches may be consumed away from home.

• Material processing at Enval has been consistent with expectations and with the quality both of aluminium and oils consistent throughout the trials and suitable for end market requirements.

• The sample size makes extrapolating accurate information about the economics of a potential UK-wide collection of aluminium containing flexible packaging difficult to forecast with any degree of accuracy.

The following recommendations relate broadly to how the lessons from this project can be applied to establish the viability of introducing a full scale local authority kerbside collection scheme for these materials.

• A full scale collection would require a non-manual solution to the separation of target material from contamination. It would be useful to carry out a trial evaluation of the effectiveness of different technology approaches to separating these material streams; however previous work carried out by WRAP indicated that eddy current separation is effective with the material despite the weight of contamination (from residual product).

• From any local authority area the regular quantities collected on a weekly basis may be small in comparison to other recyclates. Authorities may need to consider new solutions (compared to existing materials collected) to the bulking and onward shipment of this material, in particular taking note of its offensive nature in storage and transfer.

ES7 Viability factors for future recycling schemes

The viability and success of future local authority kerbside collection of aluminium containing flexible packaging on a basis other than as a trial only, is very much dependant on:

• Financial viability: cost of collection and profit elsewhere in the custody chain.
• Deliverability: suitability for inclusion within the authority’s waste collection system and contract agreements.
• Market availability: availability and stability of processing infrastructure and end markets.
• Drivers: fit with core waste drivers – e.g. reduction of residual waste (waste to landfill/residual treatment), increase in recycling rates.
• Wider benefits: fit with wider environmental objective, for example, fit with the authority’s own policy targets around waste, circular economy, sustainability, carbon, energy etc.
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## Glossary, Acronyms and Abbreviations

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<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td><strong>Bring site collections</strong></td>
<td>The practice of collecting recycling materials at central locations to which residents bring their materials.</td>
</tr>
<tr>
<td><strong>Caddies</strong></td>
<td>Designated small, lidded, collection containers which are supplied to residents for the collection of recyclable materials.</td>
</tr>
<tr>
<td><strong>Door-stepping</strong></td>
<td>The practice of canvassing householders at their property.</td>
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<tr>
<td><strong>European Commission (EC) Circular Economy Package</strong></td>
<td>A package of legislative and non-legislative proposals announced by the EC in December 2015.</td>
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<tr>
<td><strong>EU</strong></td>
<td>The European Union.</td>
</tr>
<tr>
<td><strong>Extended Producer Responsibility (EPR)</strong></td>
<td>The concept of brand owners and manufacturers taking environmental responsibility for their products and the associated packaging when they become waste.</td>
</tr>
<tr>
<td><strong>Flexible Aluminium-Containing Laminate Packaging</strong></td>
<td>Laminated films used in the manufacture of the packaging, comprising a thin foil of aluminium, which is sandwiched, or laminated, in a matrix of paper and/or plastic layers. These are used in a range of packaging formats, including pouches, bags and tubes, for the packaging of consumer goods such as food, drinks, pet foods, tooth pastes, and cosmetic products. In this report they are referred to as flexible packaging for short.</td>
</tr>
<tr>
<td><strong>Gravimetric analysis</strong></td>
<td>A method for the quantitative determination of the amount of a compound/material in a sample by measuring the difference in mass of the sample before and after certain operation. In this case, contamination content was measured by weighting samples of materials, which were then cut open, washed, and dried and then weighted again to</td>
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determine aluminium content.

**Heavy fuel oil (HFO)**
Oils that make up the distillation residue

**Kerbside collections**
The practice of collecting recyclable materials from householders' properties.

**London Metal Exchange (LME)**
The world centre for industrial metals trading.

**Mechanical Biological Treatment (MBT)**
A waste processing facility that combines a sorting facility with a form of biological treatment, such as composting or anaerobic digestion.

**Material Recovery Facility (MRF)**
A specialized plant that receives, separates and prepares recyclable materials for supply to onward reprocessing markets.

**Participation rate**
The number of households within a target area that participate in a waste collection at least once during a monitoring period (typically 3 consecutive collections), divided by the total number of households. It provides similar information to set out rate, but takes into account the fact that some householders may not set out a collection container on a specific day, e.g. because they are away on holiday or do not have sufficient waste to put out for collection.

**Polyethylene (PE) and polyethylene terephthalate (PET)**
The most common plastic laminates used in flexible packaging.

**Recyclate**
Recyclable material (material with a secondary commodity market value).

**Red diesel**
A dyed fuel.

**Refuse Collection Vehicle (RCV)**
Vehicle commonly used for the collection of waste and recyclable materials.

**Residual product**
Food, drink or cosmetic product which remains inside
a packaging item when presented for recycling.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Set out rate</strong></td>
<td>The number of containers that are set out for collection on any given day within a target area for a kerbside collection, divided by the total number of households within that area.</td>
</tr>
<tr>
<td><strong>Stillages</strong></td>
<td>A container compartment on a vehicle for storing goods in transit.</td>
</tr>
<tr>
<td><strong>Total Ion Chromatogram (TIC%)</strong></td>
<td>A plot of the total ion current vs. retention time obtained from a chromatography experiment with mass detection.</td>
</tr>
<tr>
<td><strong>WRAP</strong></td>
<td>The Waste and Resources Action Programme has a mission to accelerate the move to a sustainable resource efficient economy. It is a recognised professional body working in the space between governments, businesses, communities, think tanks and individuals to establish partnerships and deliver initiatives to support more sustainable economies and society.</td>
</tr>
</tbody>
</table>
1 Introduction

1.1 Project aim

The aim of the Flexible Aluminium-Containing Laminate Packaging Collection Trials was to undertake an active research project to understand the potential to develop and trial new post-consumer recycling programmes for flexible packaging items such as food/beverage pouches, toothpaste tubes and pet food sachets. The trials, and this report, focus on aluminium-containing laminate packaging only and not on similar flexible packaging solutions that do not contain aluminium.

1.2 Project objectives

The key objectives of the project were to:

- Assess the economic and operational feasibility of recovering aluminium from aluminium-containing laminate packaging;
- Understand public attitudes and behaviours regarding recycling of aluminium containing laminate packaging across different geographical areas and demographics in the UK; and
- Identify the effectiveness of communications materials related to aluminium-containing laminate packaging.

The project partners also produced a dissemination plan for the wider sharing of information from the trials\(^4\).

1.3 Background

There are approximately 160,000 tonnes per annum of aluminium-containing flexible packaging (such as food/beverage pouches, toothpaste tubes, pet food sachets) in the UK marketplace\(^5\). There is the potential for this to generate around 16,000 tonnes per annum of additional aluminium into the secondary commodity market if captured for recycling. Flexible packaging is becoming increasingly widespread and the global market is estimated to have a Compound Annual Growth Rate of 5.1% from 2013 to 2018\(^6\). Virgin aluminium, extracted from bauxite, has one of the highest environmental footprints of mined materials. This means that recycling of flexible packaging could make an important contribution towards reducing

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\(^4\) Which has been included in Appendix 7.

\(^5\) http://www.enval.com/process/

\(^6\) Flexible Packaging Market by End-Use (Food, Beverage, Personal Care & Pharmaceutical), Material (Polypropylene, BOPP, CPP, Polyethylene, EVOH, PA, BOPET, PVC, Aluminium, Paper, Cellulosic) - Global Trends & Forecast to 2018 Published by Markets and Markets in Nov 2013.

Anthesis Consulting Group, 2016
the environmental footprint of aluminium products as well as contributing to the UK recycling rates.

Although aluminium food and beverage containers and foil are widely collected for recycling in the UK, there are extremely limited options for recycling post-consumer flexible packaging. This is because there are a number of challenges associated with collecting and managing flexible packaging throughout the supply chain, as illustrated in Figure 1.

**Figure 1: Potential challenges for flexible packaging recycling**

These challenges mean that there has been limited experience nationally and internationally of collecting flexible packaging.

### 1.3.1 Research undertaken prior to this study

In 2011 and 2012, two WRAP funded studies explored the recovery and recycling of laminated packaging\(^7\)\(^8\). The first project (2011) involved a series of six process trials, using a pilot plant built by Enval, to process laminated packaging as a post-consumer waste. The technical and environmental viability was established, and an outline business case presented for a commercial scale plant processing 2,000 tonnes per annum which could operate alongside a Material Recovery Facility (MRF), with a payback period of four years being indicated. The 2012 WRAP study was focussed on the practicality of recovering laminated packaging from residual or “black bag” waste that was being directed to

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\(^7\) Recycling of laminated packaging, WRAP, Sept 2011  
(http://www.wrap.org.uk/sites/files/wrap/Recycling%20of%20laminated%20packaging.pdf)

\(^8\) Recovery of laminated packaging from black bag waste, WRAP, June 2012  
(http://www.wrap.org.uk/sites/files/wrap/Recovery%20of%20laminated%20packaging%20from%20black%20bag%20waste.pdf)

Anthesis Consulting Group, 2016
Mechanical Biological Treatment (MBT) facilities. The authors concluded that at the time of writing, separating laminated packaging from residual local authority collected waste was unlikely to be financially viable.

There has also been a project undertaken in France by Club de l’Emballage Léger en Aluminium et en Acier\(^9\) (CELAA) which aims to increase recycling of all types of aluminium. As part of this work, CELAA has undertaken four pilot studies to install eddy currents on the reject line of MRFs to capture small aluminium materials that would otherwise have been lost from the recycling stream (such as foil, coffee capsules and tea light holders). As part of this work flexible packaging has been captured and sent for treatment (to burn the varnishes / plastic layers and recover the aluminium).

The Flexible Aluminium Containing Laminate Packaging Collection trials that were funded by Defra between 2014 and 2015, and that are reported on within this document, aimed to build on existing knowledge and evidence to assess the feasibility of including flexible packaging as an ‘accepted’ material within different types of local authority recycling collection schemes.

### 1.3.2 The Circular Economy Package

On 2 December 2015, the European Commission (EC) proposed the adopted a new Circular Economy Package (CEP) to stimulate Europe’s transition towards increased global competitiveness and sustainable economic growth. The CEP consists of two components: an EU Action Plan\(^10\) for the Circular Economy and a set of legislative proposals. This CEP will play an important part in driving more resource efficient behaviors and practices within Europe, and the work undertaken as part of this research study can play an important part in helping to demonstrate opportunity and challenges associated with the implementation of higher recycling rates for packaging and municipal waste streams as well as highlighting the potential for circularity to support economic development potential within the UK.

A Circular Economy was defined by the Ellen MacArthur Foundation\(^11\) as a society ‘that is restorative and regenerative by design, and which aims to keep products, components and materials at their highest utility and value at all times, distinguishing between technical and biological cycles’. WRAP, the UK’s leading resource efficiency charity, further developed this description by describing the Circular Economy as ‘an alternative to a traditional linear economy (make, use, dispose) in which we keep resources in use for as long as possible, extract the maximum value from them whilst in use, then recover and regenerate products and materials at the end of each service life’. To help to understand the contribution that the Circular Economy could make towards sustainable economic growth and development

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\(^9\) http://www.celaa.fr/comprendre
\(^11\) www.ellenmacarthurfoundation.org/circular-economy

Anthesis Consulting Group, 2016
WRAP developed a European Union (EU) Vision for 2020\textsuperscript{12} which estimated that if the EU made the transition, the economic and environmental benefits could include:

- 110 billion euro increase in the EU trade balance;
- 400 billion euro in cost savings;
- 160,000 jobs created;
- 500 million tonnes of greenhouse gases avoided;
- 190 million tonnes less in extracted raw materials & imported goods used;
- 220 million tonnes less waste produced; and
- 350 million tonnes more materials recycled.

One of the key elements of the CEP is a common EU target for reuse and recycling 65\% of municipal waste by 2030, with a 60\% interim target by 2025. The latest Defra statistics show that in 2014 the amount of waste recycled from households reached 44.8\%\textsuperscript{13}. However, there is wide variation between councils and in many regions recycling rates have flat-lined in recent years. Currently there are materials which arise in the household waste stream in the UK that are not collected for recycling because of a range of factors including: poor participation and capture from residents, inability to collect and sort or process materials cost effectively, and lack of end markets for recycling resulting from low levels of demand for secondary commodities in product manufacturing. Laminated packaging will represent an increasing and important proportion of the residual waste stream to target as recycling is maximised for the ‘easier to reach’ materials (i.e. fibre, metals, plastic bottles and trays, glass, organics).

The CEP also makes provision for Extended Producer Responsibility, and specifically sets a target for 75\% recycling of packaging waste. There is an expectation that this target will support the municipal waste recycling target of 65\% and the mechanisms by which this will be delivered will undoubtedly require the formation of new partnership approaches between the different stakeholders within the packaging supply chain, from point of origin (the manufacturers and retailers) to end of life (in the municipal waste stream).

1.3.3 The role of The Department for Environment, Food and Rural Affairs (Defra) in achieving circularity

Protecting the environment for future generations, driving environmentally sustainable growth, and improving quality of life and well-being are core objectives of the Defra work programme. Encouraging businesses to manage their impact on the environment through

\textsuperscript{12} www.wrap.org.uk/content/eu-vision-2020

Anthenis Consulting Group, 2016
improved production processes and more sustainable product offerings are core elements of achieving these policy goals.

Over a number of years, Defra has invested in building and developing a robust evidence base on understanding and influencing sustainable and resource efficient behaviours to establish a strong analytical framework. This is based on available evidence and has focused on developing an in-depth understanding of current activities and how to drive transitions towards more sustainable behaviours in the future.

In the autumn of 2013, Defra started a process to commission action based research projects to test innovative approaches for encouraging sustainable behaviours in order to further extend the UK’s understanding of effective ways to drive the delivery of the Circular Economy. This was the fourth round of projects to be commissioned as part of Defra’s programme and included a commitment to finding projects which were focused on developing and trialling new, more resource efficient, product offerings (reference number: EV0547). Projects which were successful under this call were required to demonstrate actions throughout the supply chain, to improve sustainability, reduce the waste and develop the potential of innovative practice. To this end the projects generated multidisciplinary teams from a variety of organisations across the supply chain who came together to address efficient resource use and behaviour change.

1.3.4 The flexible aluminium-containing laminate packaging recycling collection trials

The trials aimed to assess the overall feasibility of collecting, consolidating and reprocessing the waste flexible packaging materials in household waste streams, allowing an assessment to be made of how such materials could be included in future household waste collection schemes.

The project was delivered by a consortium of partners representing the packaging supply chain. The partners were: Anthesis UK, Nestlé UK, Coca Cola Enterprises, Tesco UK, SUEZ UK, Bracknell Forest Council, Calderdale Council, the London Borough of Hounslow, and Enval.
Figure 2: Supply chain view of the partners

1.4 Partner Overview

Nestlé UK had an interest in the trial as it produces a number of brands such as ‘Felix’ cat food, which is supplied in pouches made from the flexible packaging material. In 2012, Nestlé produced a plan entitled ‘Building a Sustainable Future’. The Plan outlines Nestlé’s priorities including: researching and championing innovative packaging design, researching and trialling different recycling solutions, and driving zero waste to landfill.

Coca Cola Enterprises is one of the UK’s biggest users of packaging, and has undertaken significant work to understand behaviour change in householders which was used within the communications activities in the project. The packaging plays an important role in ensuring the quality and safety of their drinks as they deliver them to customers and consumers. Packaging materials also represent 52% of the carbon emissions across their value chain, and so the company is working to reduce its carbon footprint by using less material (by light-weighting their packaging), using more recycled and renewable materials and making sure its packs are fully recyclable. It sells the ‘Capri Sun’ drinks range in the UK, which uses the target flexible packaging material.

Tesco UK is progressing towards an ambition of being a zero-carbon business by 2050, working to improve resource efficiency and address sustainability risks across the supply chain. They have committed to helping their customers reduce their carbon footprint by 50% by 2020. As part of this commitment, and to stop unnecessary waste going to landfill or energy from waste facilities, Tesco has a variety of recycling options for customer materials.

Anthesis Consulting Group, 2016
located at larger stores including plastics, metals, and glass. This includes car park recycling facilities at store locations.

SUEZ UK[^14] is a recycling and resource management company with a vision to deliver a society where waste materials are reused, recycled or recovered for their energy content. To achieve its goal of ‘no more waste’ SUEZ has implemented and is undertaking a range of new and innovative service and technology solutions for its customers. SUEZ operates the waste collection services for a significant number of UK local authorities, and was instrumental in obtaining the agreement of three of their client authorities to participate in the trial of flexible packaging recycling collections, for helping with the design of the communications and for implementing the systems of collection and consolidation and measurement of the target materials.

Enval is a company dedicated to the development of unique recycling processes that provide financially lucrative and environmentally beneficial alternatives to disposal of waste. The company’s current focus is the commercialisation of a patented process to recover value from plastic aluminium laminates and composites, including (in the former) the material used in flexible packaging. The company has successfully developed and deployed a commercial scale plant for this purpose, located at the Alconbury Enterprise Zone near Huntingdon, and it was at this location that the material collected through the trials was be processed. Prior to this project, no post-consumer material had been received by the Enval facility and the plant was running mainly with post-production scrap.

Material that would be sold on to the commodity markets from a large scale implementation of recycling of this material in the future would not necessarily return into the manufacturing processes for flexible packaging, and is unlikely to be traceable to its final point of re-manufacture; for this reason it was not considered necessary to include further project partners from the product manufacturing part of the material supply chain. Enval is fully engaged with the sale of recovered and recycled materials on to the commodity markets including understanding the quality that must be achieved to enable subsequent re-processors to use the material. Whilst the trial itself was not expected to produce significant quantities of material to sell onwards to the markets, it was expected that Enval could provide essential data about the quality of material produced, from which an assessment of the price that would be obtained for the material from a large scale trial could be calculated.

The project was co-ordinated and managed by Anthesis[^15]. Anthesis has a strong track record in supporting local authorities and the private sector to trial, improve and launch new ways of managing resources.

Defra opted to support the flexible laminated packaging recycling collection trials, which are detailed in this report, because the project met a number of key delivery performance criteria including:

[^14]: In the course of this project SUEZ UK underwent a brand rationalisation exercise; therefore a number of the materials presented in this document use the SITA name and branding that were current at that time.
[^15]: Previously LRS Consultancy Ltd (www.anthesisgroup.com)
• Providing valuable insights and proof of concept. This was achieved by testing of a theoretical approach in real world situations which enhanced the understanding of key stakeholders in the flexible packaging supply chain and enabled the development of ideas and theory into practical trials.

• Enabling greater innovation and highlighting and quantifying associated risks to demonstrate change readiness.

• Establishing evidence to show which specific interventions do or do not work for collection of hard to recycle packaging materials and communication to change householder behaviours.

• Providing information to show the likely potential for scale-up and replication and the associated costs, challenges and opportunities.

• Generating rich qualitative narratives to understand the potential of the interventions being tested.

1.5 The Project Scoping Report

A scoping study was completed by the partners in 2014\(^{16}\) to design and establish the cost of running the flexible laminated packaging recycling collection trials based on both kerbside and bring-site collection methods. The resulting scoping report laid out the anticipated costs of the trials, how the operational and communications element of the trials within each area would be delivered and monitored and potential risks and mitigations.

\(^{16}\) Post-consumer collection and treatment trials of flexible packaging: scoping report- 2014

Anthesis Consulting Group, 2016
2 Trial mobilisation and operation

2.1 Introduction

This section sets out how each element of the trial was planned, mobilised and operated. Information on all communications related activities are set out in detail in Section 3. Table 1 sets out a summary list of the key mobilisation activities carried out by Anthesis and the partners prior to the beginning of trial operations.

Table 1: Summary of Mobilisation activities

<table>
<thead>
<tr>
<th>Trial aspects</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kerbside trials</td>
<td>• Initial on-line focus group work;</td>
</tr>
<tr>
<td></td>
<td>• Communications - recruitment letter design and distribution;</td>
</tr>
<tr>
<td></td>
<td>• Communications - information pack development pack and door-step campaign</td>
</tr>
<tr>
<td></td>
<td>planning;</td>
</tr>
<tr>
<td></td>
<td>• Operational preparation and training for relevant stakeholders;</td>
</tr>
<tr>
<td></td>
<td>• Vehicle and container preparation;</td>
</tr>
<tr>
<td></td>
<td>• Caddy and bag ordering.</td>
</tr>
<tr>
<td>Bring site trials</td>
<td>• Communications development;</td>
</tr>
<tr>
<td></td>
<td>• Bins design and ordering;</td>
</tr>
<tr>
<td></td>
<td>• Bin tethers / locks design and ordering;</td>
</tr>
<tr>
<td></td>
<td>• Bin liners procurement;</td>
</tr>
<tr>
<td></td>
<td>• Logistics preparation.</td>
</tr>
<tr>
<td>Processing</td>
<td>• Material sorting preparation;</td>
</tr>
<tr>
<td></td>
<td>• Logistics preparation;</td>
</tr>
<tr>
<td></td>
<td>• Enval process mobilisation.</td>
</tr>
</tbody>
</table>

2.2 Partner roles and organisation

The roles and responsibilities of each partner were formalised in contracts developed by Anthesis. The key roles of each of the partners in the delivery of the trials are summarised in Table 2.

Table 2: Roles and responsibilities of project partners

<table>
<thead>
<tr>
<th>Partner name</th>
<th>Key roles and responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>All partners</td>
<td>• Support public and trade communications;</td>
</tr>
<tr>
<td></td>
<td>• Establish any available background data and undertake elements of scheme monitoring;</td>
</tr>
<tr>
<td></td>
<td>• Input to project reports and documents.</td>
</tr>
<tr>
<td>Partner name</td>
<td>Key roles and responsibilities</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Anthesis</td>
<td>• Manage and coordinate the project including project budgets and liaison with Defra;</td>
</tr>
<tr>
<td></td>
<td>• Lead the development of project reports and documents;</td>
</tr>
<tr>
<td></td>
<td>• Identify equipment required for trial schemes;</td>
</tr>
<tr>
<td></td>
<td>• Undertake resident surveys.</td>
</tr>
<tr>
<td>Nestlé/Coca Cola Enterprises</td>
<td>• Support the development of the communications plan;</td>
</tr>
<tr>
<td></td>
<td>• Manage trial communications.</td>
</tr>
<tr>
<td>Enval</td>
<td>• Assess and quantify the quality and quantity of material received for processing;</td>
</tr>
<tr>
<td></td>
<td>• Process material;</td>
</tr>
<tr>
<td></td>
<td>• Manage the sale of the recovered aluminium on to the end markets.</td>
</tr>
<tr>
<td>SUEZ</td>
<td>• Identify the local authorities that would form the basis of the scheme and manage their engagement and involvement;</td>
</tr>
<tr>
<td></td>
<td>• Work with the local authorities to identify the trial areas and assist in the engagement with participating households;</td>
</tr>
<tr>
<td></td>
<td>• Design and manage collection operations;</td>
</tr>
<tr>
<td></td>
<td>• Undertake participation rate monitoring;</td>
</tr>
<tr>
<td></td>
<td>• Oversee delivery of communication materials;</td>
</tr>
<tr>
<td></td>
<td>• Manage the consolidation of collected materials at their Mitcham facility.</td>
</tr>
<tr>
<td>Tesco</td>
<td>• Manage the operations of the bring bank collections;</td>
</tr>
<tr>
<td></td>
<td>• Undertake in-store communications with customers.</td>
</tr>
<tr>
<td>Local authorities</td>
<td>• Identify suitable trial areas;</td>
</tr>
<tr>
<td></td>
<td>• Support scheme operations and communications.</td>
</tr>
</tbody>
</table>

### 2.3 Kerbside trials

#### 2.3.1 Local authority selection

The local authority areas for the trial were identified by SUEZ UK. The objective was to seek to identify three different geographies which operated different collection methodologies and had different demographics in order to assess how well collection schemes might performed in each. The partners were also keen to work with one authority which had an incentive programme in place in order to understand the impact that incentives could have on public participation on the trial. SUEZ UK’s Technical Development Director worked closely with SUEZ Contract Managers for different local authority contracts in order to identify suitable local authority areas for the trial. A short list of local authorities was developed and discussed with the partners. Once three suitable authorities had been identified and agreed with Defra, Anthesis and the SUEZ arranged meetings with the relevant local authority representatives to outline the project, define the roles and responsibilities of the partner authorities, define the benefits and obtain agreement for participation. Following verbal agreement each local
authority partner was provided with a letter of support to sign in order to demonstrate commitment to the project. The trial authorities and geographic areas agreed were:

- Calderdale Council: Sowerby Bridge;
- Hounslow Council: selected areas within Chiswick Riverside, Hounslow West, Syon, Heston West and Feltham West;
- Bracknell Forest Council: Warfield and Bulbrook;

The collection schemes in each of the areas are described further in sections 2.3.3, 2.3.4 and 2.3.5.

### 2.3.2 Household recycling equipment

Anthesis carried out research to identify appropriate equipment for householders to store and present flexible packaging in with the final materials agreed in discussion with the project partners. Partners agreed that each household should be provided with a standard silver/grey 7 litre food waste type caddy and an initial roll of 50 orange coloured polythene liners with ‘Recycling Trial’ printed on each bag. Key factors in the decision made on these materials were:

- The caddies would retain an odour from the residues within the flexible packaging (which is important given that flexible packaging products can be hard for householders to empty entirely and clean);
- Both caddies and polythene recycling bags have had widespread use within local authority recycling schemes so the health and safety and manual handling considerations are well known;
- Caddies and polythene bags and have been proved to be convenient for householders and cost effective for local authorities via use in other types of recycling scheme;
- The bags were coloured orange with ‘Recycling Trial’ lettering in order to be easily visually identifiable to crews and householders and visually separate to those provided for food waste or other collections and;
- To provide materials in such a way that surplus could be reused elsewhere following the trials; i.e. using generic messaging on bags and standard size and colour caddies.

### 2.3.3 Trial Approach - Calderdale Council

The trial in Calderdale used an ‘opt-out’ approach to recruiting residents to participate in the new recycling scheme. This approach was chosen in order to contrast it with the ‘opt-in’ approaches used in Bracknell Forest and The London Borough of Hounslow (the impact of opt-in vs. opt-out approaches have been discussed in Section 5). A group of properties within...
the Sowerby Bridge area were identified as the target population for the trial. The properties were selected on the basis that they formed part of a high recycling area and the partners felt that this would help to demonstrate the trial could be successful to other residents in the authority area should it be rolled out further. In selecting this area, the partners acknowledged that the results obtained from this particular trial would be likely to be indicative of the best performance possible as regards recycling of flexible packaging within the local authority area. The number of properties that could be invited to take part in the trial was limited to around 250 as this was the number that could be serviced using the existing SUEZ vehicles and within the agreed project budget. It was a recognised limitation of the trial that this number of households would be insufficient to give a true statistical representation of the area.

All properties within the area were sent a leaflet\(^{17}\) introducing the trial. Following this door to door canvassing was then undertaken achieving a 63% contact rate. In total, 259 of the households contacted agreed to participate in the trial and were given a silver/grey 7 litre caddy (as illustrated in Figure 3), a roll of 50 orange liner bags and an information leaflet.

SUEZ operates a kerbside sort collection system on behalf of Calderdale Council whereby recyclable materials are sorted into different compartments of a stillage vehicle during collection. The recycling collection vehicle servicing the households within the trial area was fitted with an additional bag inside one of its existing stillages to contain the bagged flexible packaging presented by householders.

**Figure 3: Collections being undertaken in Calderdale**

\(^{17}\)Further information is provided in subsequent sections and in the appendix.

Anthesis Consulting Group, 2016
2.3.4 Trial Approach - Bracknell Forest Council

The trial within Bracknell Forest Council recruited residents from the Warfield and Bulbrook areas of the authority which contain around 6,500 properties. This area includes a mix of income groups, with social housing, estate developments and larger single-build houses. Bracknell Forest operates a recycling incentive scheme through which residents can obtain points that can be exchanged for chargeable council services such as the use of leisure facilities, internet use at the library and tickets for events. The participants in the flexible packaging recycling trial received extra recycling points for signing up to participate and setting materials out for collection thereby incentivising them to take part in the trial. The partners selected Bracknell Forest as a trial area in order to assess whether the incentive scheme influenced participation in the trial relation to the approaches taken in other local authority areas.

All existing communication with residents registered for the Council’s incentive scheme is carried out by email and these contact details were therefore available for use during the trial. This method of communication would not have been available across the whole Bracknell Forest Council area. In order to recruit residents to the trial, an initial email was sent to residents who participated in the council’s incentive scheme and who lived within the selected areas of the authority. The email included a link to a survey which was designed to gain feedback on trial communication materials and asked whether residents would be interested in participating in the trial. This element of the trial was therefore asking residents to ‘opt-in’ to participate in contrast to the ‘opt-out’ approach used in Calderdale. Residents who opted into the trial were sent a further email to confirm their participation. 404 properties Bracknell Forest residents were divided into two Zones of 202 residents each, for separate assessment during the trials; data from Warfield was subsequently collected and recorded as ‘Zone 1’ and Bulbrook was recorded as ‘Zone 2’.

SUEZ delivered a 7 litre caddy, roll of orange liners, and a detailed service leaflet to each of the households that had opted to take part in the trial. Since all residents in the trial were already subscribers to the Council’s recycling information emails, residents in Bracknell Forest were not targeted with specific door-stepping to provide trial information and engagement.

SUEZ undertakes fortnightly collections of comingled dry recyclables in Bracknell Forest (as an alternate week collection with refuse) using single bodied collection vehicles. Following collection, the recyclable materials are sent to a MRF for sorting. The feasibility of bagged flexible packaging being co-collected with the other recyclables within the vehicle was investigated however the potential loss of materials and impact on MRF operations meant that this was not considered a feasible method of collection. The potential for adding a separate chassis cage to the collection vehicles was also considered however this was again found to be unfeasible for the purposes of the trial. Therefore, the bagged flexible packaging was collected using a separate caged tipper vehicle visiting half of the trial households each week. This provided a fortnightly collection service for flexible packaging on the same day that other dry recyclables were collected. A single driver-loader was used to undertake the
collections and the flexible packaging was delivered to Wokingham transfer station (as Bracknell Forest did not have a suitable licenced location).

**Figure 4: Collections being undertaken in Bracknell Forest**

![Image of collections being undertaken in Bracknell Forest]

### 2.3.5 Trial Approach - The London Borough of Hounslow

A number of areas within the Chiswick Riverside, Hounslow West, Syon, Heston West and Feltham West were selected by SUEZ and the London Borough of Hounslow as being suitable for inclusion in the trial on the basis that they were generally representative of the different demographic and social groups within the borough. The intention was that 7,300 households within these areas would be sent a letter informing them about the trial and encouraging them to opt-in to participate. The first 180 households to reply were selected to take part in the trial. However, issues with the distribution of the letter meant that some households did not receive it and as a result only 88 households initially contacted the council to opt in to the trial. To address this, Anthesis undertook door to door canvassing to encourage further households to participate in the trial. As a result of this canvassing a total of 187 households were recruited to participate in the trial. All households that had opted in were given a 7 litre caddy, roll of orange liner bags and a service information leaflet delivered as part of the door-stepping process.

SUEZ provides a kerbside sort recycling collection scheme on behalf of the London Borough of Hounslow. Materials are presented by residents in boxes and reusable sacks and are sorted into different compartments of a stillage vehicle by collection crews. Residents set out the bagged flexible packaging with their other recyclable materials and the collection crews sorted it into a spare “between the wheels” storage container on the recycling collection vehicles as part of their normal collection activities. The flexible packaging was bulked as a separate stream of materials at the material bulking facility at Hanworth (which is the site used by LB Hounslow to bulk other kerbside collected materials).
2.3.6 Summary of recruitment approaches

Table 3 provides a summary comparison of the approach taken to recruiting residents in each area.

Table 3: Summary of recruitment approaches

<table>
<thead>
<tr>
<th></th>
<th>Bracknell Forest</th>
<th>Calderdale</th>
<th>Hounslow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial information</td>
<td>Email</td>
<td>Leaflet delivery</td>
<td>Leaflet delivery</td>
</tr>
<tr>
<td>notice</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recruitment</td>
<td>Email</td>
<td>Doorstep-canvassing</td>
<td>Doorstep-canvassing</td>
</tr>
<tr>
<td>No. residents recruited</td>
<td>404</td>
<td>259</td>
<td>187</td>
</tr>
</tbody>
</table>

2.4 Bring site trials

In addition to the kerbside trials, the partners planned to locate collection containers for flexible packaging within the local authority areas. The intention was that these bring sites would help to increase the amount of flexible packaging collected from the trials as well as allowing those residents outside the kerbside collection trial areas in each authority to recycle their flexible packaging. In order for investment in the bring trial to be successful it would be important that a sufficient number of sites could be identified (i.e. to make data analysis possible) and that sufficient communications (e.g. point of sale material within stores) could be put in place to attract users. It was planned that bring sites would be placed at Tesco.

Anthesis Consulting Group, 2016
stores in each area and, at the request of Calderdale Council, a further bin would be provided within the Sowerby Bridge Household Waste Recycling Centre in Calderdale.

2.4.1 Tesco bring sites

Once agreement had been reached with each of the nominated local authorities that kerbside collection trials could be undertaken within their areas, Anthesis engaged with Tesco to agree suitable stores for the proposed bring site trial. Suitable Tesco stores were identified on the basis that they were within the three local authority areas of Calderdale Council, London Borough of Hounslow and Bracknell Forest Council and had existing bring sites with sufficient space for locating the container for flexible packaging. Unfortunately due to a record of excessive flytipping (which is a common problem for retail store based bring sites in particular) a number of stores in the three areas had recently limited or closed their bring site provision. Tesco was, however able to identify six store sites which were suitable for the trial.

Table 4: Tesco Stores nominated for inclusion in the bring site trial

<table>
<thead>
<tr>
<th>Authority area</th>
<th>Store/city location</th>
<th>Facilities serviced by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bracknell Forest Council</td>
<td>Bracknell</td>
<td>Bracknell Forest Council</td>
</tr>
<tr>
<td></td>
<td>Bracknell North</td>
<td>Bracknell Forest Council</td>
</tr>
<tr>
<td>LB Hounslow</td>
<td>Osterley</td>
<td>Tesco (via Tesco contractor)</td>
</tr>
<tr>
<td></td>
<td>Twickenham</td>
<td>Tesco (via Tesco contractor)</td>
</tr>
<tr>
<td>Calderdale Council</td>
<td>Halifax</td>
<td>Tesco (via Tesco contractor)</td>
</tr>
<tr>
<td></td>
<td>Sowerby Bridge</td>
<td>Tesco (via Tesco contractor)</td>
</tr>
</tbody>
</table>

In order for the proposed bring site operations to be approved for participation in the trial, Tesco had a number of requirements:

- Committee approval was obtained for involvement in project and for proposed operation;
- Approval of marketing material and use of Tesco brand in project communications;
- Approval of bin site equipment (bins, tethering post and lock mechanism);
- Health and safety approval of bins and equipment through testing at Tesco’s Welwyn head office site;
- All operators coming onto Tesco sites for installation, servicing and removal (post trial) of the bins should be Tesco approved contractors.

Following the Tesco advice on internal procedures, Anthesis identified suitable equipment and bins. Bins selected were standard 240 litre wheeled bins fitted with a locking lid with a rubber flap (similar to those used for food waste). Bins were to be fitted with bespoke fabricated metal liners to meet Tesco fire prevention requirements by the supplier Straight
Anthesis liaised with existing Tesco Contractor KDM Shopfitting to arrange the supply and fitting of tethering posts and locks.

The expectation was that bring sites would be serviced throughout the trial period by one of the Tesco waste contractors already providing services to the sites. In each case for the nominated sites, this was either the local authority or DS Smith.

However, prior to the launch of the scheme, the decision was made to cancel the bring site trials. This decision was agreed by the partners for a number of reasons:

- Length of lead-in time from initiation of Tesco approval procedures to operation of trial;
- Recent experience of low performing and difficult to operate bring site trials for trigger-heads (i.e. spray cap mechanisms as commonly found on domestic cleaning liquids) at Tesco stores in south west England;
- Low number of suitable sites available within the three target council areas and;
- Higher than expected quoted costs for installation and removal of bins.

Despite the cancellation on the bring site trials, Tesco agreed to remain a partner for the overall project.

2.4.2 Local authority bring site

Calderdale Council expressed interest in locating a bring bin at their Sowerby Bridge HWRC site to support the kerbside collections. After the cancellation of the Tesco bring site trial, it was recognised that it would not be possible to collect useful statistical data from the location of a single bring site. The Sowerby Bridge proposal was therefore also cancelled at this stage.

2.5 Material sorting

During the project setup phase, it was decided that sorting operations for the collected material would be carried out centrally at SUEZ’s Mitcham facility which includes a waste transfer station and a MRF. The decision to use this facility was largely based on the experience of SUEZ staff at the facility in waste composition analysis (as they are usually deployed to check samples of incoming material against waste acceptance criteria). The partners felt that the facilities and expertise used for waste composition analysis would also be suited for sorting of the flexible packaging collected from the trial areas.

The core elements of the sorting operation were to:

- Accept incoming material transferred from each of the three council collection areas;
- Record the total weight of material collected;
Flexible Aluminium Containing Laminate Packaging Collection Trials

- Open collection bags;
- Separate and weigh any unacceptable contamination (recorded as ‘gross contamination’ e.g. food waste, nappies and other materials that would cause severe problems during the processing operations);
- Separate and weigh any non-target material (i.e. materials that may have been mistaken for flexible packaging by householders such as items of similar appearance not containing aluminium, e.g. plastic-only food pouches, and crisp bags) and;
- Record numbers of bags, quantities of target material, non-target material and unacceptable contamination by collection area.

Prior to commencement of operations, Anthesis visited the Mitcham site and worked with SUEZ to develop a protocol and record sheets for the material sorting and analysis task. This has been included as Appendix 1.

Following the analysis undertaken at SUEZ’s Mitcham site, the flexible packaging was packaged and transferred to Enval’s site in Alconbury for processing.

2.6 Material transfer operations

Anthesis engaged with a number of courier companies to discuss the suitability of their services for the provision of material transfer operations during the trial. This operation required four regular material movements during the trial operations i.e.:

- Scheduled transfer of material between each of the three collection trial areas and SUEZ’s Mitcham facility.
- Scheduled transfer of material from SUEZ’s Mitcham facility and Enval’s facility in Alconbury.

The courier selected to carry out the operations was required to hold a current waste carrier’s licence and be aware of the regulatory requirements for transferring this material and managing waste transfer notes. In order to manage the transfer operation, Anthesis also had a regulatory requirement to register as a waste broker.

Due to the nature of the material, in particular the odour, Anthesis, with support from staff at each SUEZ site, worked with the courier to ensure the packaging was as suitable as possible for the transfer operation. These changes were made partly in response to feedback from the courier organisation. For packaging the material, SUEZ therefore ensured that, prior to transfer:

- All material was double bagged and each bag sealed as airtight as possible to minimise the potential for leaks of liquid or odour.
- Bags were packaged inside a cardboard carton to prevent damage to bags.

Anthesis Consulting Group, 2016
From July onwards, responding to continued odour problems in storage and transit (particularly as the weather warmed for the summer), materials were transferred weekly using a same-day courier, with transfers scheduled as closely as possible to collection or sorting days to minimise storage time.

All of the boxes were carefully labelled to identify the originating area (including whether Zone 1 or 2 in Bracknell Forest) and were accompanied by an appropriate waste transfer note.
3 Communication materials and activities

3.1 Introduction

The communications development and delivery was considered to be a key part of the project, and the impact of the materials on householder behaviour change would be crucial to the participation and levels of contamination during the trial. To this end, getting the communications right was a key part of the development of the project.

3.2 Communications protocol development

The first stage of the communications planning process was to jointly agree a protocol to which all partners would subscribe throughout the project delivery. This document stated the required approvals procedures for media relations, social media, direct contact and customer service, crisis management, and the development of the trial's communications. The sign off timescales for each communication channel were also set out in this document and the time frames were designed to enable the partners to effectively deliver the project. A copy of the protocol is provided in Appendix 2. The purpose of this plan was to ensure the effective management and joint agreement of all materials produced in subsequent stages of the project.

3.3 Communications plan development

Following the successful completion of the scoping study, the partners organised and facilitated a workshop to bring together knowledge and experience of each in public behaviour change. The aims and objectives were to:

- Generate an environment for information sharing about good practice;
- Agree the access to intellectual property/materials which would be beneficial to the project delivery;
- Agree timelines and responsibilities for the development of the trial communications materials.

A copy of the presentations from the workshop has been provided in Appendix 3. Using the outcomes from this workshop, Anthesis developed a comprehensive communications plan. Communications needed to use a range of methods, channels and activities to stimulate the uptake of new behaviours and ensure people continue with them. In order to develop strategic approaches that take in a wider range of potential activities which can influence behavioural change, Defra produced a framework – the 4Es model - to help plan communications for behaviour change. The framework is designed to ensure that all the
factors necessary to change behaviour are present. The framework was developed as part of the UK’s Sustainable Development Strategy – Securing the Future, published in 2005\(^\text{18}\). This evidence-based strategy gives a strong lead to delivering sustainable behaviour change by engaging individuals, households and communities. It recognises the complexities that influence behaviour and the need for the consistent approach required to change deep-seated habits. The 4Es model defines a new approach that focuses on the need to enable, encourage and engage people to help them towards sustainability (by for example recycling) and recognises that there are four key elements (to enable, encourage, engage and exemplify) that are necessary for change to take place, the aim being for the combined package to catalyse people into action and for the new behaviour to become the norm over time. A diagram showing the 4Es model is depicted in Figure 6.

**Figure 6: Defra 4Es model for behaviour change.**

**Defra 4Es model:**


Source: Defra
The communications plan, developed by the partners, also used WRAP’s research into the identification of communications channels which are particularly effective for certain purposes with regards to householder recycling communications.

Figure 7 illustrates WRAP’s model and shows the most appropriate communication methods for different audiences and purposes, where the width of the grey colour shading in each column shows how effective an approach is (least grey in a target audience box indicates least effectiveness).

**Figure 7: Effective communication channels**

| Recycling Competence Level (1 to 7) | Description | Messages | a) Instructions – what, when and how to recycle: Details of service and how to use it | b) Explanations – what is recycling? Why should you do it? What are the benefits to people and the environment? | c) Debunk myths – education about what is good & bad in recycling & waste disposal | d) How it works – what happens to recyclables once collected | e) Feedback and thanks – How we are doing compared to everywhere else | f) Saving cash – what is the cost of recycling, waste disposal, LATs etc. |
|-----------------------------------|-------------|----------|---------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| 1. Recycling unaware              | Just not on their radar, no idea about it at all ACORN: 2, 4 Age: 16-24 Property: Flats, terrace, maisonette lifecycle: Young single, no kids yet; single parent | Leaflets, Calendars, RTI/box stickers, Contamination tags | Door knocking & leaflets, Local displays/events, Adverts - TV & local radio, local newspapers, outdoor |                                                                                     |                                                                                      |                                                                                                 |                                                                                                 |                                                                                                 |                                                                                                 |
| 2. Aware but inactive             | Know about it but have not seriously contemplated doing it ACORN: 2, 4 Age: 18-34 Property: Flats, terrace, maisonette lifecycle: Young single, no kids yet; single parent | Door knocking & leaflets, Local displays/events, Adverts - TV & local radio, local newspapers, outdoor |                                                                                     |                                                                                      |                                                                                      |                                                                                                 |                                                                                                 |                                                                                                 |                                                                                                 |
| 3. Contemplated but not engaged   | May have dabbled, possibly elsewhere, may do occasionally, drifted back ACORN: 2, 4, 5 Age: 18-34 Property: Terrace, bungalow lifecycle: Solitary retiree, single parent | Leaflets, Newsletters/council newspaper, Local PR |                                                                                     |                                                                                      |                                                                                      |                                                                                                 |                                                                                                 |                                                                                                 |                                                                                                 |
| 4. Unreliable                    | Recycle but sometimes forget, or miss out, recycle opportunistically not regularly ACORN: 3, 5 Age: 35-54 Property: Bungalow, terrace lifecycle: Solitary retiree, solitary adult worker | Vehicle livery, PR Newsletters, Council newspaper, Advertisials, Events/dispers |                                                                                     |                                                                                      |                                                                                      |                                                                                                 |                                                                                                 |                                                                                                 |                                                                                                 |
| 5. Trying their best             | Usually take part, recycle staple items but confused about other items ACORN: 3, 5 Age: 35-54 Property: Semi-detached, bungalow lifecycle: Full nest couple with kids, solitary retiree | PR, Newsletters, Council newspaper, Advertisials, Events/dispers |                                                                                     |                                                                                      |                                                                                      |                                                                                                 |                                                                                                 |                                                                                                 |                                                                                                 |
| 6. Broadly competent              | Reliable and regular but may still miss out some materials or collections ACORN: 1, 2 Age: 55+ Property: Detached, semi-detached lifecycle: Empty nest, couple with no kids | PR, Newsletters, Council newspaper, Advertisials, Events/dispers |                                                                                     |                                                                                      |                                                                                      |                                                                                                 |                                                                                                 |                                                                                                 |                                                                                                 |
| 7. The Complete Recycler           | Recycle all available items of all recyclable materials all of the time ACORN: 1 Age: 55-64 Property: Detached lifecycle: Empty nest, children living elsewhere | PR, Newsletters, Council newspaper, Advertisials, Events/dispers |                                                                                     |                                                                                      |                                                                                      |                                                                                                 |                                                                                                 |                                                                                                 |                                                                                                 |

At the heart of the communication plan was the recognition that this project did not require mass marketing / advertising and the understanding that the channels and messages used needed to work with a very targeted audience group. The communication plan, which is contained in Appendix 4, included:

**Branding and messaging**

- Photography – containers (kerbside and Tesco) and packaging;
- Design;
- Online focus group survey.

**Local authority trials**

Anthesis Consulting Group, 2016
- Letter;
- Leaflet distributed with container;
- Door step canvassing;
- Local media, websites and social media;
- Staff training.

**In-trial engagement**
- Email;
- Door step canvassing.

**Tesco store trials**\(^1\)
- Container branding;
- Options for Point of Sale material; i.e. Shelf talkers, Table talkers, Flyers in-store (noticeboard / customer service desk).

**Surveying**
- Online survey / Door-step surveying.

Following approval of the plan, each of the partners provided packaging pictures of the in-scope items for use within the communications materials and Anthesis appointed specialist designers, DTW, to produce some draft messaging and visual identity designs for the trials. The draft materials were based on the national Recycle Now branding and were tested using an online survey targeted at residents in Bracknell Forest. The residents of Bracknell Forest were selected to participate in this survey because the council had their email addresses and knew that they were engaged in recycling activities as a result of the Green Points Scheme which was in operation at the time. The purpose of this testing was to identify how materials could have the greatest impact in terms of:
- Front page colour (blue and green);
- Titles;
- Positioning of brands/products;
- Terminology and descriptions and different materials that were to be targeted for separation.

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\(^1\) This communication work was planned for the bring sites, but following changes to the delivery model was not developed.

Anthesis Consulting Group, 2016
The questions used in the online survey and the results are provided in Appendix 5. Using the feedback obtained from residents the communication materials were finalised. Examples of these communications are also provided at Appendix 5.

3.4 Kerbside trial communication interventions

Communication and surveying was undertaken with all participants to provide participants with information to support participation and help understand residents' perceptions of the trial. This was undertaken at 3 key stages during the trials:

1. Pre-trial as part of the recruitment and initial door-stepping exercises;
2. Mid trial, as both an information gathering and participation intervention exercise;
3. End of trial, in order to gather information and also inform residents of the end of trial.

3.4.1 Pre-trial communication interventions: canvassing

Pre-trial communications served to recruit and confirm involvement of residents (as opt-in in Bracknell Forest and opt-out in Hounslow and Calderdale, see Sections 2.3.3 to 2.3.5).

- In Bracknell Forest, residents were communicated with and recruited via email since all residents were existing subscribers to the council’s incentive scheme.
- In Calderdale and Hounslow, residents were contacted directly through door-stepping. Residents were provided with information by the door-stepping team and had the opportunity to ask questions.

Canvassing was preceded by the circulation of a local authority-specific flier informing residents that the trial was about to take place. Figure 8 shows an example front page of the flier (as circulated in Hounslow).
Figure 8: Front page of recruitment leaflet, as branded for use in the London Borough of Hounslow

Once recruited, participating residents were provided an information leaflet (as illustrated in Appendix 5), giving details of the trial operation, the materials being collected and background information on why the trial was taking place. These were provided together with each resident’s caddy and roll of liners. A sticker was also provided to residents to affix to their caddy, providing a further reminder of materials which could and could not be included.

Throughout the trial period participating residents had the opportunity to call their council helpdesk for information. Helpdesk staff were provided with script information to support residents’ enquiries through this route.

3.4.2 Mid trial communication interventions

Just after half way through the trial, after discussion with Defra to agree the approach, communication interventions were undertaken with participants in all three trial areas to communicate progress and to encourage continued participation for the remainder of the trial. These interventions were scheduled to take place during the first two weeks of July to ensure that all engagement activities were completed prior to the start of the school summer.

Anthesis Consulting Group, 2016
holidays, thus avoiding the peak holiday season as far as possible and reducing the potential of reduced contact rate due to residents being away from home.

The principle objectives of the interventions were to:

- Thank residents for their participating to date;
- Provide positive feedback about the useful data being gathered in the trial;
- Encourage residents to participate, if they had not put their container out for collection previously;
- Reinforce and explain in more detail as necessary the message to residents regarding what could and could not be recycled, to help increase recycling and reduce contamination.

These mid-trial interventions were not designed to perform a detailed survey with residents.

In each area, interventions were developed to achieve these objectives however the interventions differed slightly to ensure that messaging was appropriate to the individual trial area, to differences in performance and to the slightly differing collection and participant recruitment processes. Although some differences in approach to interventions would be necessary to ensure that they were correctly targeted (and allowed for the different communications approaches used i.e. email in Bracknell Forest and direct door-stepping elsewhere), it was agreed with Defra that it would be important to ensure these communications were rolled out sufficiently consistently so that the impact of interventions could be compared across the areas. The focus of interventions for each of the three areas is described in the following sections.

3.4.3 Bracknell Forest

Throughout the trial, communication with Bracknell Forest residents was principally through email since these residents were all part of an existing email correspondence list with the council. The mid trial intervention was therefore also carried out via email (sent by the council). Previous emails requesting a response had a 30% response rate. Therefore, for this established group, the project team was confident that this would be a sufficiently effective communication mechanism. The email to Bracknell Forest residents was sent out with the messaging included in Box 1 below. Residents were also provided with a pdf copy of an update and information leaflet and were invited to return comments on the trial to Bracknell Forest Council.
Box 1: Recycling trial update messaging sent to Bracknell Forest residents (July 2015)

Recycling trial update

Thank you for making the effort to take part in our flexible plastics and aluminium packaging recycling trial.

We wanted to remind you about what you can and can’t recycle when taking part over the next few months. Please continue to recycle all your:

- Food pouches;
- Drinks pouches (no cartons);
- Pet food pouches (no trays or tins);
- Instant coffee refill pouches;
- Coffee grounds pouches;
- Toothpaste tubes;
- Cosmetic tubes.

Please do not include any other items in this recycling trial. See attached leaflet with details about exactly what can and can’t be recycled in this trial.

Thank you once again for your efforts and we will be back in touch towards the end of the trial, in November 2015.

3.4.4 Calderdale and Hounslow

Anthesis staff canvassed door-to-door at all of the properties registered on the trial in Calderdale and Hounslow in order to engage as many participants as possible face-to-face. A flyer was developed to be handed to residents for them to retain further information regarding the trial. Flyers were posted through the letterboxes of the homes where nobody was available. The canvassing team was briefed in detail on the project so that they could provide appropriate information to residents in response to any questions. The remit provided to Anthesis staff to carry out the canvassing was:

- To attempt to engage the trial participants at each specified household.
- To make 2 attempts to visit participants should they be out; however if there is still no answer, to post the flyer through the letterbox.
- If someone is home, ask first to speak to the person that would normally do the recycling at home.

Anthesis Consulting Group, 2016
• Engage residents about how to participate in the trial and help to overcome any perceived barriers to recycling.

• Ask:
  o Whether the resident is participating in the trial;
  o What types of material they have been recycling;
  o Why not participating (if not);
  o Whether they use the materials recycled as part of the trial;
  o If they have any specific questions about the operation of the trial;

• Provide resident with flyer and thank resident for taking part.

Similarly to Bracknell Forest, no formal survey was undertaken in Hounslow or Calderdale at mid-trial. However, given the nature of the direct engagement in these areas, there was an opportunity to collect additional useful information, further details of which are provided in Section 3.4.2.

3.4.5 End of trial communication interventions: survey

Surveys were undertaken with participants 2 weeks prior to the end of the trial. The purpose was threefold:

• To gather information from participating residents regarding the performance and suitability of the trial activities and their attitudes to the trial;

• To inform residents that the trial was drawing to a close and advise the final collection day;

• To thank residents for taking part in the trial.

Residents in Calderdale and Hounslow were surveyed directly by Anthesis staff through doorstep visits. In line with the approach for the previous communications, Bracknell Forest residents were contacted via email and were invited to participate in an online survey.

End of trial surveys were carried out to collect as robust data as possible on the performance of the trial from the perspective of residents. Surveys were designed to be concise and as simple to answer as possible in order to promote quality responses. All residents were provided with the same list of questions to respond to, which included a mixture of guided and free responses. The list of questions is included below in Table 5.

The results of the end of trial survey have been discussed in Section 3.4.5.
## Table 5 End of trial survey questions and guided responses

<table>
<thead>
<tr>
<th>No.</th>
<th>Question and responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Have you been participating in the flexible packaging recycling trial at any point during the last 9 months?</td>
</tr>
<tr>
<td></td>
<td>Yes                                      No                                      Unsure</td>
</tr>
<tr>
<td>2</td>
<td>What specific packaging have you been recycling for this trial? (Not prompted)</td>
</tr>
<tr>
<td></td>
<td>Full list of desired packaging listed in leaflet</td>
</tr>
<tr>
<td></td>
<td>Full list of non-desired packaging listed in leaflet</td>
</tr>
<tr>
<td>3</td>
<td>Do you know what materials were used to make the packaging collected for this trial? (Not prompted)</td>
</tr>
<tr>
<td></td>
<td>No                                       Yes, alu and plastics                      Yes, plastics                  Yes, aluminium   Yes, other</td>
</tr>
<tr>
<td>4</td>
<td>Can you name any of the brands or companies that manufacture the packaging that supported this trial?</td>
</tr>
<tr>
<td></td>
<td>Nestlé                                   CCE                                     Tesco                        SUEZ / SITA      Nescafe        Felix          Capri-Sun</td>
</tr>
<tr>
<td></td>
<td>Ella’s Kitchen                           Enval                                    Defra                        Council          Other (please state)</td>
</tr>
<tr>
<td>5</td>
<td>Do you remember receiving information about the trial in July?</td>
</tr>
<tr>
<td></td>
<td>Yes                                      No                                       Unsure</td>
</tr>
<tr>
<td>5a</td>
<td>If yes, what action did this result in you taking with the trial?</td>
</tr>
<tr>
<td></td>
<td>Continued recycling the same types of packing</td>
</tr>
<tr>
<td></td>
<td>Started recycling the trial</td>
</tr>
<tr>
<td></td>
<td>Started recycling more materials</td>
</tr>
<tr>
<td></td>
<td>Stopped recycling some materials</td>
</tr>
<tr>
<td></td>
<td>Stopped recycling all the materials</td>
</tr>
<tr>
<td></td>
<td>Unsure</td>
</tr>
<tr>
<td>5b</td>
<td>Did our engagement make you take any actions with your other waste and recycling services? (state options)</td>
</tr>
<tr>
<td></td>
<td>More dry recycling</td>
</tr>
<tr>
<td></td>
<td>More food waste</td>
</tr>
<tr>
<td></td>
<td>Less dry</td>
</tr>
<tr>
<td></td>
<td>Less food waste</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Unsure</td>
</tr>
<tr>
<td>6</td>
<td>Did you have any problems or issues participating in this trial? (Not prompted)</td>
</tr>
<tr>
<td></td>
<td>Missed collections</td>
</tr>
<tr>
<td></td>
<td>Not frequent enough collections</td>
</tr>
<tr>
<td></td>
<td>Not enough bags</td>
</tr>
<tr>
<td></td>
<td>Containers too big</td>
</tr>
<tr>
<td></td>
<td>Containers too small</td>
</tr>
<tr>
<td></td>
<td>Couldn’t recycle other packaging</td>
</tr>
<tr>
<td></td>
<td>Smell</td>
</tr>
<tr>
<td>7</td>
<td>Would you continue to participate if the trial service offered became a permanent part of your recycling services?</td>
</tr>
<tr>
<td></td>
<td>Yes                                      No                                       Unsure</td>
</tr>
<tr>
<td>7a</td>
<td>If not, why not?</td>
</tr>
<tr>
<td></td>
<td>Don’t buy product packaging any longer</td>
</tr>
<tr>
<td></td>
<td>Smell</td>
</tr>
<tr>
<td></td>
<td>Space</td>
</tr>
<tr>
<td></td>
<td>Collection issues</td>
</tr>
<tr>
<td></td>
<td>Other</td>
</tr>
<tr>
<td></td>
<td>Unsure</td>
</tr>
</tbody>
</table>
### Flexible Aluminium Containing Laminate Packaging Collection Trials

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>8 Has participating in this trial changed your buying habits?</strong></td>
<td>Yes, we bought more flexible plastic packaging products</td>
</tr>
<tr>
<td></td>
<td>Yes, we bought less flexible plastic packaging products</td>
</tr>
<tr>
<td></td>
<td>No, it stayed much the same</td>
</tr>
<tr>
<td></td>
<td>Unsure</td>
</tr>
<tr>
<td><strong>9 Age range</strong></td>
<td>18-25</td>
</tr>
<tr>
<td></td>
<td>26-34</td>
</tr>
<tr>
<td></td>
<td>35-44</td>
</tr>
<tr>
<td></td>
<td>45-54</td>
</tr>
<tr>
<td></td>
<td>55-64</td>
</tr>
<tr>
<td><strong>10 Gender</strong></td>
<td>Male</td>
</tr>
<tr>
<td></td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>Transgender</td>
</tr>
<tr>
<td></td>
<td>Prefer not to say</td>
</tr>
<tr>
<td><strong>11 Ethnicity</strong></td>
<td>Provide detailed list</td>
</tr>
</tbody>
</table>
Flexible Aluminium Containing Laminate Packaging Collection Trials

4 Trial Results

4.1 Kerbside collection data

4.1.1 Participation by Households

Set-out data was recorded by SUEZ collection crews during normal collection rounds. Using this method of collecting set-out and participation data was expected to introduce inaccuracies as the crews to not always have the time resources to ensure that every collection is correctly recorded. The method does however enable the data to be collected during every collection day which was, at project design stage, considered to be a cost effective approach for collecting multiple data samples across the whole trial period. The alternative approach, for additional staff to be employed to follow collection crews for just a small number of weeks during the trial period, was considered to provide a small sample size that may not be able to fully take into account the potential variation in set out across the trial period. Set-out was recorded against each individual address to enable participation to be assessed across the whole trial period.

Scrutiny of the set-out data collected for each area showed up shortcomings in the data for all areas, but in particular for Calderdale and Hounslow. The set-out and participation data presented and discussed throughout this section is therefore from the two Bracknell Forest trial zones.

Figure 9 shows data on the participation of households in the two Bracknell Forest zones over the whole trial period.

Figure 9: Average frequency of set-out in Bracknell Forest
The data in Figure 9 shows the frequency that households in Bracknell Forrest set out their bins. This data potentially provides some insight into the appropriateness of the frequency of bin collection, which in Bracknell Forest was every 2 weeks. Although a proportion of residents used the collection service on the fortnightly basis provided (12% and 8% for Zones 1 and 2 respectively), the majority (on average) of households are shown by the data to be setting out their bin for collection less frequently than 2-weekly with a significant proportion using the service only 1 time in every 4 collections, or less.

Figure 10 shows how set out rate in Bracknell Forest changed over time during the trials.

**Figure 10 Set out rate over time in Bracknell Forest**

The number of householders setting out their bin at each opportunity decreases on average over the lifetime of the trial (the chart shows a power curve through the individual points). Visually, there does appear to be some evidence of a small recovery in set-out rate after week 12, which correlates with the timescale for mid-trial interventions.

During the trial each of the participating council’s communications help desks were provided with a script to help them to answer questions which might have been raised by householders about the collection of flexible packaging; however, no calls on this matter were recorded during the trial from any of the authorities.

### 4.1.2 Number of bags sorted from each collection area

Figure 11 shows the number of bags sorted in each area each week for the lifetime of the trial. This data does not directly relate to the number of households setting out bags for collection given that some households set out more than one bag on a number of occasions. The data for number of bags sorted over time relates both to bags collected and the frequency of transfer to the SUEZ sorting location at Mitcham. Until July 2015,
transfer of material was less frequent, initially on demand and subsequently fortnightly. From July onwards transfers from Calderdale and Bracknell Forest were scheduled weekly; although Hounslow remained on-demand.

**Figure 11 Number of bags sorted over time**

The highest number set out by a householder for a single collection in the trial was 12 bags. Rather than this being a householder who stored recycling over a number of weeks, this was by a householder who consistently set out more bags than average and rarely missed a collection over the period of the trial. The data in the chart provides information on the quantity of bags collected in each area and the variability in the number of bags collected per week across the trial period. Broadly speaking, the information shows higher numbers sorted that arose in Bracknell Zone 1, but a more similar distribution per week for the other areas.

### 4.2 Waste sorting and contamination data

On arrival at the SUEZ MRF in Mitcham, material was weighed and separated into target and non-target material with this data recorded against the date and originating collection area.

#### 4.2.1 Material received at sorting (weight)
Figure 12 compares the total weight of material received in Mitcham from each area. To an extent this information reflects the number of bags collected from each of the areas but also, as discussed below the average weight and contents of each bag.

**Figure 12: Total weight of material received in Mitcham**

Figure 13 compares the average weight per bag between each area. The chart clearly shows the total weight per bag in to be broadly similar for three of the areas and the average bag in Bracknell Forest Zone 1 being just over 25% greater.

**Figure 13: Average weight per bag in each area**

In terms of the actual amount of material collected, and again using the data obtained in Bracknell Forest, the average annualised amount collected per household would be 3.13 kg. Extrapolating this to the whole country would mean that the total available amount of laminate packaging is ca. 82,000 tonnes. As presented in the introduction, figures from the aluminium trade associations indicate that there are 160,000 tonnes per year of these materials. Even accounting for the small nature of the sample used for this study, this
discrepancy is likely to be due to capture rates. A 50% capture rate from participating households would be reasonable given that it is a known fact that materials arising in the bathroom are often not recycled (meaning some toothpaste and cosmetic containers would not be captured) and that some of the packaging items in the project scope are likely to have been disposed of out of home (for example the baby food pouches and some of the drinks pouches), meaning that they are not available for recycling in a kerbside collection.

4.2.2 Contamination levels

Figure 14 shows average proportions of contamination found from sorting bags for each area.

Figure 14: Contamination levels in each bag collected

The chart shows, in combination with Figure 13 that although total weight of bag is similar for Hounslow, Calderdale and Bracknell Forest Zone 2, the proportions of target and non-target material differ between the three; Bracknell Forest Zone 2 has on average the lowest contamination rate of the 4 areas: 24% compared with the highest rate, Hounslow with 38%.

Figure 15 shows the contamination rate data plotted over the lifetime of the project. The chart clearly shows a greater level of consistency in the contamination rates in the two Bracknell Forest areas, (mainly between 20 and 30%) when compared to the spread of the Calderdale contamination data. There are limited data points for Hounslow, however this again appears to suggest greater variation.
4.3 Participant survey data

The following charts set out data collected during the mid-trial intervention and end of trial survey. This information is broadly as entered by participants in the survey either through the web-survey in the two Bracknell Forest areas or through engagement with the doorstep survey team in Hounslow and Calderdale.

Figure 16 and Figure 17 provide some information relating to the socio-demographic differences between the 3 areas.
The trial intentionally avoided areas with any significant number of flats in order to avoid the additional impacts caused by lack of storage for the material pre-collection. Although in all areas the trial targeted individual houses, the areas differ significantly with Hounslow having a dominance of terraced properties, Calderdale an even split between terraced, semi-detached and detached properties and the Bracknell Forest areas with a significant dominance of detached properties.

Similarly significant are the ethnic differences between Hounslow and the other two areas. Both Bracknell Forest and Calderdale are listed as predominantly or entirely white British while the population in Hounslow shows much more variation with the ‘White British’ making up less than 55% of the residents and the remaining ~45% consisting of a number
of different distinct or mixed ethnic groups. As discussed in Section 5.2, the impact of a wider variation in ethnic group also has a knock-on impact on language and the effective

4.3.1 Data from mid trial interventions

The mid trial interventions included a limited survey element with the principal aims being to raise awareness of the trial and remind and reinforce the messages that had been communicated at the beginning of the trial in February 2015. The data in Figure 18 provides assurance that the majority of those interviewed did remember receiving information about the trial.

Figure 18: Do respondents remember receiving information about the trial?

Figure 19 shows the response to whether residents felt the trial had affected their overall recycling behaviour. Broadly the impact of the trial was shown to have a positive effect on recycling behaviour with households in all areas in terms of starting recycling and recycling more materials.
4.3.2 End of trial survey

The end of trial survey included a series of 11 questions that have been set out in Section 3, Table 5.

Figure 20 shows that, based on responses there was a significant difference between the areas at trial end whether residents were still participating in the trial. The chart shows a high level of remaining participation in Bracknell Forest but that around 50% of residents in the other two areas had dropped out of the trial by that stage.
Some of the principal reasons for dropping out are set out below in Figure 21. In each case there are a significant number of residents who did not feel they used any or enough of the materials that could be recycled to warrant taking part, this included responses from 100% of the Bracknell residents who dropped out of the trial. Further residents provided separate comment about the frequency of some of the materials, for example cosmetic product packaging which may last an extended period of time before becoming empty and being recycled.
Figure 22 provides some information, based on a breakdown of data from Bracknell Forest, of the types of materials that householders recycled during the trial. This information is not representative of the quantity of each, but shows the number of households recycling each.

**Figure 22: What materials are households putting in their bins for recycling?**

![Bar chart showing the number of households recycling various product types.](chart)

The two highest scoring material types, toothpaste tubes and cosmetics are unlikely to provide a large quantity of material for recycling and will not necessarily be produced frequently.

The survey question presented in Figure 23 tested residents’ awareness of the packaging itself and the material constituents being targeted for recycling. Bracknell residents showed a good level of understanding however the result may not be altogether be comparable with Hounslow and Calderdale given that the Bracknell survey was carried out by email and residents may have used the trial leaflets to help answer the questions. 40-50% of Hounslow and Calderdale residents showed some understanding of the materials that the trial was focussing on.
**Figure 23:** From the trial, are residents aware what is in the flexible packaging being recycled?

The response compared in Figure 24 suggests that buying habits for flexible packaging were not significantly changed in any of the areas as a result of the trials.

**Figure 24:** How did the trial affect buying behaviour for flexible packaging
Finally, residents were asked if they remembered who the project partners were and which brands the trial was linked with. Figure 25 provides a comparison of the responses to this question. The question prompted a wide range of brand names with the majority being specific products that may be suitable for recycling through the trial. A number of the core partners and brands were represented in the responses for each area.

**Figure 25: Are respondents aware of the partners supporting the trial and the brands that are being collected?**

![Graph showing responses to awareness of partners and brands]

### 4.4 Material processing data and value of products

The procedure followed by Enval on receipt of the boxes of packaging was as follows:

- Take sample for residual product contamination assessment;
- Manually sort waste for qualitative and quantitative assessment;
- Processing of material using the Enval process;
- Assessment of the aluminium produced;
- Assessment of the oils produced.

After carrying out these steps it was also possible, based on the experience and knowledge that Enval has regarding the specifications of the actual laminates that are used to produce each of the different types of packaging, to compare the yield of aluminium from the processing trials with the “theoretical” yield expected. This is important...
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to enable improved future estimations of likely aluminium yield from similar packaging based purely on waste composition data and is discussed in Section 5.8.

4.4.1 Waste assessment for residual contamination

Upon receiving the boxes of flexible packaging, Enval took samples of the contents in order to carry out an assessment of internal contamination using gravimetrical analysis. For this purpose, the samples were weighed, washed, dried and weighed again.

Visual examination showed samples to be generally relatively clean. There was an exception during the mid-part of the trial (over the summer) where pet-food pouches coming from Bracknell Forest had more residual product inside. There was no evidence on which to base a reason for this variation.

Quantitatively, the level of contamination remained the same over the whole trial and was very similar for the three areas as shown in Table 6. It should be noted that the contamination observed at Enval was (from a collection perspective) additional to that already removed during the material sorting process carried out by SUEZ; discussed in Section 4.2.

Table 6: Average product contamination in the material received at Enval

<table>
<thead>
<tr>
<th>Area</th>
<th>Product residue contamination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bracknell</td>
<td>22.7%</td>
</tr>
<tr>
<td>Calderdale</td>
<td>23.5%</td>
</tr>
<tr>
<td>Hounslow</td>
<td>23.0%</td>
</tr>
<tr>
<td>Average</td>
<td>23.1%</td>
</tr>
</tbody>
</table>

The contamination data at Enval always included samples of tubed cream and pastes such as toothpaste, which have been observed to cause the highest level of residual contamination in the laminate packaging, increasing the average of the sample\(^{20}\) as a whole.

4.4.2 Waste assessment for type of product

After completing the contamination tests, Enval carried out a full inspection of each of the boxes received in order to separate the packaging by type of product and carry out a qualitative assessment of the types of product packaging received. It was found that by far the most common type of packaging found throughout the trial, in terms of units and of total mass, was pet-food pouches; specifically wet cat food.

\(^{20}\) On average a disposed tube of toothpaste consists of 14 g of toothpaste and 7 g of packaging meaning that 66% of the disposed amount is residual product.
This task also enabled a validation of the sorting operation previously carried out by SUEZ staff at its Mitcham site. In general and as expected it was clear that the sorting operation had been correctly carried out and although some few non-target materials were found in some of the boxes, the levels were generally low and well within the level expected for a manual sorting operation.

Figure 26 shows the typical distribution of products found in one of the boxes received at Enval. The cardboard box at the top of the image contains all the cat food pouches included with this sample.

**Figure 26: Qualitative assessment of the waste received at Enval by type of product**

For one consignment received, Enval carried out a further, fully quantitative, analysis of the types of products received from Bracknell Forest and Calderdale. The results, set out in Figure 27, showed the distribution to be very similar for both areas.

**Figure 27: Quantitative assessment of the waste received at Enval by type of product**
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(a) Bracknell Forest samples:

- Catfood: 86.4%
- Capri Sun
- Ella's Kitchen
- Brooklea
- Nature's Menu
- Tesco teabag wrapping
- Douwe Egberts Senseo
- Nescafe
- Misfits
- Tubes
- Other

(a) Calderdale samples:

- Catfood: 76.7%
- Capri Sun
- Ella's Kitchen
- Tubes
- Heinz
- Hipp Organic
- Tesco Goodness Slurper
- Coffee sachets
- Coffee bags
- Other
4.4.3 Material processing using the Enval process

Processing of the material using the Enval process was a straightforward operation and there were no unexpected process problems. In terms of contamination (according to Enval) the process is designed to be able to cope with expected levels of residual product corresponding to the levels found in the samples received; therefore this contamination did not cause any issues during processing.

In non-technical terms, the Enval process can be described as follows:

- The packaging waste is fed into the shredder via a hopper at the beginning of the process (Figure 28).
- Shredded laminate material is transported using a conveyor system (Figure 29) towards the oven and the oxygen level is reduced.
- The materials are fed into the oven where the Microwave Induced Pyrolysis process takes place.
- The aluminium exits the process in flake form (Figure 30).
- In the oven the plastic turns into a gas that is extracted from the oven and cooled down to room temperature. This fraction primarily produces an oil that can be used for a variety of uses. A fraction of the gas produced in the oven does not condense at room temperature and is collected as a gas that can be used to power the whole process; i.e. the process becomes self-sufficient from an energy point of view.

**Figure 28: Packaging in the shredder hopper**
4.4.4 Assessment of the aluminium produced and value

The aluminium produced by the Enval process with the materials collected and treated was consistent with the aluminium obtained from other sources of material (i.e. pre-consumer) and consistent throughout the length of the trial. According to the Enval, this was expected given that any level of residual product contamination has very little impact on the quality of the metal recovered and only affects to a very small degree (as discussed in Section 4.4.5) the quality of the oils. Visual examination of the metal consistently showed a shiny surface on one of the sides and a slightly black-tinted surface on the other. Again, this is normal given that the majority of the packages collected and treated throughout the trial consisted of laminates that have polyethylene (PE) on one side and polyethylene terephthalate (PET) on the other. Whereas the pyrolysis of PE leaves no residue on the surface of the aluminium, the pyrolysis of PET does leave a layer of char on the surface of the aluminium, which is negligible in terms of weight, but still noticeable by visual inspection.

Figure 30: Photo of the aluminium produced with a trial consignment
Tests were carried out to evaluate the metal yield of the aluminium produced. Samples taken from the aluminium produced are melted using flux salts, recording the original weight of aluminium flakes and the final weight of the molten aluminium. The difference in both weights corresponds to the mass lost due to burning (char from the pyrolysis process) or dross produced from other impurities and from the aluminium oxide that naturally forms on the surface of the aluminium. The resulting metal yield data is important as the principal characteristic that affects the market value of the aluminium.

From the trials carried out in this project, the metal yield of the aluminium obtained varied between 57% and 66%. Again, this is consistent with the metal obtained with pre-consumer, clean waste, demonstrating that the presence of residual food and other contamination in post-consumer waste did not affect the quality of the metal.

**4.4.5 Assessment of the oil produced and value**

Similarly to the aluminium, the quality of the oil produced during the processing of the consignments received was consistent throughout the trial. On visual inspection the oil is a very viscous brown liquid at around 20°C and if kept any colder it forms a waxy material.

The chemical composition of the oil was analysed using gas-chromatography coupled to mass spectrometry (GC-MS). As expected this analysis showed that the oil is a mixture of a large number of hydrocarbons, mainly alkanes and alkenes ranging from C_5 to C_32. In practical terms, this means that the oil has a variety of uses, the most common one, as heating fuel in substitution for more common fuels in kilns or as starter fuel in energy from waste plants.

The summary of the typical average chemical composition and characteristic on the oil is presented in the table below.

**Table 7: Average chemical composition and characteristics of the oil produced**

<table>
<thead>
<tr>
<th>Composition</th>
<th>Values in weight % unless otherwise stated</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of compounds</strong></td>
<td><strong>Values in weight % unless otherwise stated</strong></td>
</tr>
<tr>
<td><strong>Components</strong></td>
<td><strong>Fraction</strong></td>
</tr>
<tr>
<td>C_6 - C_12</td>
<td>37.0%</td>
</tr>
<tr>
<td>C_13 - C_21</td>
<td>34.4%</td>
</tr>
<tr>
<td>C_22 - C_32</td>
<td>19.4%</td>
</tr>
<tr>
<td>Water</td>
<td>8.3%</td>
</tr>
</tbody>
</table>
A typical Total Ion Chromatogram (TIC%) of the oil produced and a detailed analysis of the oil has been presented in Appendix 6.

Although the oil is currently classified as a waste product under the Waste Framework Directive it does not prevent it from being sold commercially and the oil commands a value when it is sold as a commodity. Further details are provided in Section 5.9.2.
5 Trial Outcomes

5.1 Set up and establishment of the trial

The set up and establishment of a novel collection trial would not be expected to be without challenges. The partnership itself brought together a group of organisations with differing objectives, operational approaches and corporate / decision making processes.

The trials were set up over a lead-in period of c. 6 months and as a result there were a few changes over that time. One of the key changes affecting delivery was the reduction in the number of Tesco locations with bring facilities operating within the 3 trial areas. This was one of the principal factors in the decision (upheld by all partners) not to go ahead with the bring site collection element of the trial; based on the small sample size that would be achieved from targeting just six stores across the three areas.

The nature of local authority waste collection contracts is that, even if the operator (i.e. SUEZ) is the same, each contract is likely to operate very distinctly. To operate a specialist trial such as this within the flexible and mobile staff allocations of a municipal contract can create local issues in terms of the continued education and training of the specific collection teams. For a novel collection service such as offered in this trial and one that is only offered to selected households across the collection area, this lack of specific training and awareness did cause some problems in terms of collection. The mobilisation of the kerbside trial was implemented broadly as planned and to timescale. Contingencies to ensure sufficient recruitment of residents were used effectively in Hounslow (i.e. additional doorstep canvassing) and all areas were up and running with kerbside collections within the first 2 weeks of February as planned.

5.2 Socio-demographic differences

The demographic differences between the three trial areas were driven by the differing populations themselves. The ethnic mix of the population (based on participants in the end of trial survey) was extremely limited in both Bracknell Forest and Calderdale with the participants broadly classifying themselves as ‘White British’ in both areas. This was very different in Hounslow which provided a much wider ethnic mix; 45% of the population classifying themselves within one of 19 alternative descriptions of ethnic background. In Hounslow, from a messaging and communications perspective, this mix of ethnic background is reflected in that c. 30% of the population\(^{21}\) do not speak English. In comparison, only 7% of Bracknell Forest residents and 5% of Calderdale residents are not English speakers. The expectation would therefore be that participation would be lower among residents for whom language differences made communication less effective and that this would affect Hounslow in particular in this trial.

\(^{21}\) Data from 2011 Census
In each case streets with a predominance of flats were avoided; the trial constituted mainly detached, semi-detached and terraced properties. However, due to the characteristics of the location there was a significantly higher proportion of terraced and semi-detached houses in Hounslow compared to Bracknell Forest, and to a lesser extent than Calderdale. The space and odour issues concerning storage of material between collections would be expected to be linked to housing type and impact on participation performance (i.e. lower participation in Hounslow as a trial area); however, evaluation of that specific factor was not a quantitatively measurable objective in this trial.

5.3 Recruitment differences

The performance of the trial was expected to reflect differences in the residents recruited in each area and the method of their recruitment. The Bracknell Forest area was expected to be highest performing given that residents were recruited from:

- A known sample of existing committed/interested recyclers;
- Residents provided with incentive points through an existing council scheme for taking part;
- Residents were recruited through an opt-in sample taken from this already interested group.

Calderdale residents were selected on an opt-out basis, this selected residents for inclusion both based on willingness to participate and those who chose not to respond. That approach would be expected to therefore select a proportion of residents who from the outset were not likely to participate or who may not produce much of the target material. The approach taken in Calderdale is however closer to how a new collection service would be rolled out by a local authority in real terms.

The Hounslow service was again an opt-in service with residents encouraged firstly to contact the council to volunteer involvement and secondly being encouraged to opt-in through direct contact – i.e. using the door-step canvassing team. Whereas Calderdale Council also performed reasonably on the trial, the low performance recorded in Hounslow was due less to the recruitment process as to the problems delivering the collection service itself that have already been discussed above in Section 5.1.

5.4 Participation during the trial

Once the trial was operating and over the lifetime of the trial, there was a gradual decrease in participation by residents across all areas. This experience is normal for any new recycling collection programme; however in this case there were also a number of specific reasons for drop-off, recorded through the mid-trial intervention and end of trial survey collection.

For some residents participation was simply affected by the low incidence of relevant material. It was noted by residents that many of the specific materials would only be emptied on an infrequent basis in the home. These include toothpaste tubes, cosmetics
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and to perhaps a lesser extent, coffee and tea refills. Participation data analysed from Bracknell Forest (Figure 9) showed that, in Zone 1 (for example) although 12% of residents took advantage on average of the fortnightly frequency of the service, the majority used the service less frequently with nearly 60% using the service only once every 4 collections (i.e. 8 weekly) or less (this does not include those who did not participate at all).

The highest volume use of the trial was for pet (principally cat) food pouches. This was noted at each stage of analysis, by survey, material sorting at Mitcham and analysis at Enval. For these residents however, participation came along with odour and handling issues given that they were asked to rinse pouches before placing out for collection; odour issues were mentioned by a number of residents in the end of trial survey.

Figure 31: Residents perceived issues with participating in the trial

Feedback from residents in all areas was therefore clearly split between those stating that they did not have enough material to recycle and a considerably smaller number who had a large quantity. Lack of material was the predominant reason given by residents for not participating. The highest frequency use by residents was for toothpaste tubes.

During the trial no compositional analysis was undertaken on the residual containers and materials collected from any of the participants, so it is not possible to verify whether materials suitable for inclusion in the trial collections were, in fact, entering the residual waste stream.

5.5 Material recognition
Analysis of material at the SUEZ MRF in Mitcham provided data on both the quantity of contamination and the type of materials that were incorrectly placed in the container. The predominant non-target materials collected throughout the trial were:

- Crisp packets and similar plastic films such as biscuits and chocolate wrappers;
- Non-target cosmetic bottles and tubes – i.e. not containing aluminium;
- Food/drinks pouches not containing aluminium;
- Aluminium foil;
- Medicine blister packs.

In each case these materials allude to an attempt by residents to understand the trial and the materials that should be recycled. However, across the trial percentage contamination was on average 29% and as high as 38% on average for the Calderdale samples. This indicates that residents did encounter some problems correctly identifying target material. This contamination does not include contamination from product remaining within the packaging – i.e. residual cat food, toothpaste etc which is discussed in Section 5.8.

### 5.6 Transfer of materials

One of the greatest challenges faced in the operation of the trial was in regard to the transfer of material between the council areas and Mitcham and onwards from Mitcham to Enval’s processing facility. The principal problems with the transfer operation were:

- The small quantities of material being shipped (becoming simply a cost/unit weight issue with the transfer).
- The offensive nature of the waste – with the predominance of pet food pouches being a primary contributor in terms of odour.

The trial initially used a standard next-day courier service, delivering the transfer cost effectively through that existing network based on the low quantities being transferred from each location at any one time. Issues of odour and leakage caused complaints from courier staff during the trial and in particular during warmer summer weather. One shipment of material between sites was disposed after having been stored in a warm warehouse environment for a 2-week period (courier transfers were initially carried out 2-weekly) and that data lost to the project. The approach for packaging was changed in response to these issues and more frequent movements were implemented from July onwards.

To a large extent the issues encountered during transfer reflect the operation of the trial itself and the need to use (principally due the quantity of material being transferred) small volume courier transport rather than established waste bulk transfer infrastructure / providers. However the odour problems have been highlighted at every stage (resident storage through to processing) of the operation of the trial and would need to be taken into
account in the design of any long-term collection scheme for this material. This may result in mitigation measures being taken during intermediate bulking storage or material transfer and consideration of more frequent material movements than for some other materials collected for recycling. It may also provide support for more locally accessible sorting and treatment of the material, e.g. based at MRF’s where a wider range of recyclable materials are currently separated / sorted.

5.7 Material sorting

Material sorting is one area that would need to be better developed in order for a commercial scale scheme to be considered. The approach used for the trial was 100% manual sorting, which for a large quantity of material would obviously not be cost effective.

Based on trials carried out by WRAP, existing eddy current separation techniques would be able to separate laminated materials on a commercial scale and would even be effective for toothpaste tubes, which, based on the data, would have one of the highest contamination rates (based on residual content weight to packaging ratio) of the materials targeted.

5.8 Processing

Material processing at Enval operated in line with expectations and with the quality both of aluminium and oils consistent throughout the trials and suitable for end market requirements. The process has managed the levels of contamination found in the material i.e. post manual sorting and resulting from residual product such as cat food, toothpaste etc remaining in the packaging.

From the trials carried out in this project, the metal yield of the aluminium obtained varied between 57% and 66%. Again, this is consistent with the metal obtained with pre-consumer, clean waste, demonstrating that the presence of residual food and other contamination in post-consumer waste did not affect the quality of the metal recovered.

At this value of metal yield and at today’s prices, the metal obtained from the process could have a value of approximately £630 / tonne. However, it is important to note that this value will always depend on the value of aluminium in the London Metal Exchange (LME). Less than a year ago the value of the aluminium with the same metal yield would have been approximately £800 / tonne and before the 2008 economic crisis, £1,370 / tonne.

The value of the oils, again this will always depend on the price of crude oil which affects the value of other products such as red diesel and heavy fuel oil (HFO) which the oils from the Enval process can be used as substitutes for in heating applications. From the analysis done and although the amounts produced were not enough to be sold, Enval has established that in current market conditions and considering that at the time of writing the
price of crude oil is at its lowest level of the last 15 years, the oils could in principle be sold at a price of approximately £45 per tonne.

5.9 Economic evaluation

The results of the trial have enabled the project partners to prepare an estimate of the economic impacts of a UK-wide collection of aluminium containing flexible packaging. Data used for the calculation was provided by SUEZ and Enval and has been based both on the outcomes of the trial and on hypothetical scenarios. The resulting economics are indicative only, as they are based on a limited sample size, but have been provided in this report to demonstrate the potential costs and contribution to recycling rates of kerbside aluminium containing flexible packaging recycling schemes.

5.9.1 Collection costs

Collection cost estimates have been made based on two different scenarios. Caveats and assumptions for each scenario are explained in this section.

5.9.1.1 Scenario 1- good performance scenario

Estimated costs for a UK-wide collection scheme in Scenario 1 have been based on the following assumptions:

- 3.13kg per household is collected for recycling each year.
- 80% participation is achieved across all households in the UK (a significantly higher participation than was achieved in the trial).
- Collection is via under-vehicle boxes (which some vehicles already have but would require adaptation for most collection fleets), because the total tonnage collected per round is forecast to be sufficiently low for this approach to work effectively.
- No additional time is required per shift to collect the material from the doorstep.
- No additional charges apply for the movement of materials or storage at the local transfer station.
- Material is returned to the local transfer station post collection and then transported to centralised treatment stations (estimates have been based on assumptions around the number of consolidation centres, volume moved in bulk and distance travelled).
- Equipment depreciation is calculated over a 5 year period.
- Material management costs are incurred throughout the collection and pre-treatment process.

5.9.1.2 Scenario 2- expected performance scenario
Estimated costs for a UK-wide collection scheme in Scenario 2 have been based on the following assumptions:

- 3.13kg per household is collected for recycling each year.
- 30% participation is achieved across all households in the UK (a figure which represents average participation in Bracknell Forest Zone 1 during the trial).
- Collection is via under-vehicle boxes (which some vehicles already have but would require adaptation for most collection fleets), because the total tonnage collected per round is forecast to be sufficiently low for this approach to work effectively.
- Some additional time is required per shift to collect the material from the doorstep.
- Some additional charges apply for the movement of materials or storage at the local transfer station.
- Material is returned to the local transfer station post collection and then transported to centralised treatment stations (estimates have been based on assumptions around the number of consolidation centres, volume moved in bulk and distance travelled).
- Equipment depreciation is calculated over a 5 year period.
- Material management costs are incurred throughout the collection and pre-treatment process.

The estimated cost for each scenario are summarised in Box 2

**Box 2: Estimated collection costs**

<table>
<thead>
<tr>
<th>Scenario 1</th>
<th>Scenario 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated total cost per tonne of collection and pre-treatment ~£42</td>
<td>Estimated total cost per tonne of collection and pre-treatment ~£68</td>
</tr>
<tr>
<td>Estimated contribution to UK recycling figures ~0.2%</td>
<td>Estimated contribution to UK recycling figures ~0.09%</td>
</tr>
</tbody>
</table>

Some costs have been excluded from the estimations, including:

- The provision of caddies and bags to householders for the collection of the material.
- Washing and/or shredding pretreatments prior to onward transport to the reprocessing facility.
5.9.2 Reprocessing costs and revenue generation

Estimated costs for reprocessing have been based on the following assumptions:

- There is a reprocessing facility located at each of the centralised treatment stations and so there is no onward transportation cost associated with movement of materials post pre-treatment.
- The reprocessing plants operate for 16 hours a day, 5 days a week for 50 weeks of the year.
- Each plant has a capacity of 2,000 tonnes per year.
- The averages composition of laminates is 17% aluminium and 83% plastic.
- Material management costs (staff and services/utilities) are incurred throughout the process.
- The price of aluminium is £630 per tonne and the price of oil is £45 per tonne.
- The operator does not charge a gate fee at the plant.

The assumed figure for the income from the sale of aluminium and oil is based on an average of the market values over the duration of the project delivery period. Although the oil is currently classified as a waste product under the Waste Framework Directive it does not prevent it from being sold commercially and the oil commands a value when it is sold as a commodity\(^{22}\).

The economic evaluation for reprocessing is presented in Box 3.

**Box 3: Estimated costs and revenue generation for reprocessing**

- Operating cost: ~£5 per tonne
- Gross profit per tonne: ~£84

As highlighted in other parts of this report, there are a number of further factors which should be given consideration:

- The trials used specific collection methodologies which may not be the most appropriate for a national rollout of a flexible packaging recycling scheme; for example, it may not be necessary to provide collection bags and caddies to householders and it may not be necessary to make modifications to vehicles to facilitate the collection of the materials. It is known that eddy current separators could segregate these materials thus providing a

\(^{22}\) The inclusion of the oil as a waste product under the classification system is something that is expected to be reviewed in the short to medium term.
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The method by which the laminates could be co-mingled with other recyclables, reducing the overall collection cost.

- Changes to the commodities markets and specifically the prices commanded by the aluminium and oil from the reprocessing will impact the revenue generation; for example, at specific points during the trials the price of the aluminium was quoted at £800 per tonne, and although the oil price was stable during the trial period it is also subject to periodic fluctuations.

5.10 Lessons learned

Table 8 summarises key lessons learned from the operation of the trial that would support the development of future similar trials for collection of novel materials.

Table 8: Summary of key lessons learned

<table>
<thead>
<tr>
<th>Theme</th>
<th>Key lessons learned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collection area selection</td>
<td>In the operation of the trial there have been particular problems with delivering the kerbside collection operations in the Hounslow area with these problems broadly resulting from the training and engagement of the workforce. As part of a development of a future trial we would recommend further due diligence on the expertise available in any location, including an emphasis on the need to focus a core of trained collection staff able to support the duration of the project.</td>
</tr>
<tr>
<td>Sample size</td>
<td>The trial engaged a small number of participants, which was a direct relationship with the budget available. However, results are difficult to analyse and calculations of costs and revenue are hard to evaluate based on such a small sample size.</td>
</tr>
<tr>
<td>Participation recording</td>
<td>The trials in Bracknell Forest have collected reasonably good quality data on resident participation, however this has not been the case in either Hounslow or Calderdale. Collecting additional information during the normal operations is a challenge to waste collection crews who are under considerable time pressure to complete their work. In Bracknell Forest collection of this information is to an extent normal practice, linked to the administration of the council’s recycling incentive scheme. We would recommend: Specific training provided to collection staff to ensure collection of participation data. Contingency budget could also be reserved to enable a specific participation study to be carried out on several occasions during a trial, should it be apparent that the collection staff are struggling to collect the data required.</td>
</tr>
<tr>
<td>Material transfer</td>
<td>There were issues throughout the trial due to the offensive nature of the material (mainly odour but also some leakage) in storage and transit. We would recommend more detailed consultation with the nominated courier/shipper of material prior to start of any future trial to evaluate the material and make recommendations for any likely issues concerning its storage, packaging and transfer.</td>
</tr>
</tbody>
</table>
5.11 Conclusions, recommendations and viability factors for future recycling schemes

5.11.1 Conclusions

The following conclusions are made based on the data collected during the trial and presented in Sections 4 and 5 of this report.

- Arisings of aluminium containing flexible packaging material varies considerably from household to household with many householders considering that the quantity they produce is either too small or too infrequent to warrant collection. Other householders (particularly those with pets) may produce significant and regular quantities.

- Although there have been some operational delivery issues concerning collection of bags during this trial, these should be easily overcome in full roll-out of a similar scheme given that the collection would become part of normal operations for the crews in any council area.

- It is clear that there remain issues of recognition for the public identifying the correct materials to recycle. Average contamination rates across this trial ranged from 24% (Bracknell Zone 1) to 38% (Calderdale) with the average bag containing 29% by weight of non-target material. It is not clear from this trial how this could be rectified as these contamination rates remained consistent throughout and despite further information being provided mid-trial. In Bracknell, current data for the regular dry recyclates collected by SUEZ suggest a contamination rate of 12.5% for these established materials, c. half of the contamination in the laminate packaging collected during the trials. It may be useful to carry out further focus-group engagement to evaluate how recognition could be promoted by the information provided to residents.

- Capture rates are likely to reflect the fact that some packaging, including pet food pouches may enter the residual stream due to issues of recognition or, for example because of ‘yuk’ factor considerations, because some cosmetic and toothpaste tubes arising in the bathroom may not be put in recycling and some baby food and drinks pouches may be consumed away from home.

- Material processing at Enval has operated consistent with expectations and with the quality both of aluminium and oils consistent throughout the trials and suitable for end market requirements. The process has managed the levels of contamination found in the material i.e. post manual sorting and resulting from residual product such as cat food, toothpaste etc remaining in the packaging. Metal yields have been consistent with the metal obtained with pre-consumer, clean waste, demonstrating that the presence of residual food and other contamination in post-consumer waste did not affect the quality of the metal. Based on today’s prices, the metal obtained from the process could have a value of approximately £630 / tonne although this will be subject to market fluctuations.
Flexible Aluminium Containing Laminate Packaging Collection Trials

- Oils have similarly been of consistent quality throughout the trials. From the analysis done and although the amounts produced were not enough to be sold, Enval has established that in current market conditions and considering that at the time of writing the price of crude oil is at its lowest level of the last 15 years, the oils could in principle be sold at a price of approximately £45 per tonne.

- The sample size and the potential to roll out recycling schemes using different methods of collection make extrapolating accurate information about the economics of a potential UK-wide collection of aluminium containing flexible packaging difficult to forecast with any degree of accuracy, but it is possible to generate indicative data sets.

5.11.2 Recommendations

These recommendations relate broadly to how the lessons from this project could be applied to establish the viability of introducing a full scale local authority kerbside collection scheme for these materials.

- A full scale collection would require a non-manual solution to the separation of target material from contamination. It would be useful to carry out a trial evaluation of the effectiveness of different technology approaches to separating these material streams; however previous work carried out by Enval indicated that eddy current separation is effective with the material despite the weight of contamination (from residual product).

- From any local authority area the regular quantities collected on a weekly basis may be small in comparison to other recyclates. Authorities may need to consider new solutions (compared to existing materials collected) to the bulking and onward shipment of this material, in particular taking note of its offensive nature in storage and transfer.

5.12 Summary

The viability and success of future local authority kerbside collection on a basis other than as a trial only, is very much dependant on:

- Financial viability: cost to the authority; profit elsewhere in the custody chain.

- Deliverability: suitability for inclusion within the authority’s waste collection system and contract agreements.

- Market availability: availability and stability of processing infrastructure and end markets (i.e. cost risk).

- Drivers: fit with core waste drivers – e.g. reduction of residual waste (waste to landfill/residual treatment), increase in % recycled.

- Wider benefits: benefit to wider environmental objectives e.g. fit with the authority’s own policy targets around waste, sustainability, carbon, energy etc.
Flexible Aluminium Containing Laminate Packaging Collection Trials

Financial viability will be a principal concern to local authorities and their waste contractors. Any significant change to a waste collection service will require a positive business case projection and potentially sign-off from elected members. As part of a co-mingled collection there may be minimal additional cost in the collection operation itself beyond initial communications investment in promoting the change to residents. As part of a segregated box/kerbside sort service, there may be more infrastructure and staff time changes required to implement collection. Collection containers would also need to be suitable for the collection for this to be viable (e.g. suitable spare capacity and with consideration of potential littering problems from open containers).

This project did not include any comparison of the different methods of collection that could be employed by local authorities for flexible packaging and it would probably be unlikely that a small contributing material to an authority’s waste collection (in volume and weight terms) would regularly be collected as a separate segregated material, as has been the case in this trial. That method of collection suited the operations and outcomes of the trial in terms of examining whether residents would collect and set out the material for collection.

Separate studies (including those carried out by Enval) have identified that due to the aluminium content, this packaging can be segregated effectively using eddy current separation from a co-mingled recycling stream.

At a first level a business case would look for the cost on implementation and operation to be met and preferably exceeded through their own point of contact with the external market; i.e. by a combination of (a) reduced cost of residual waste disposal and (b) revenue from handling/reprocessing operations. This should be stable through the investment pay-back period and projected medium term. At a secondary level an authority/waste contractor would wish to see a return on investment through increase in recycling and decrease in residual disposal / treatment.

An additional driver and potential contributor towards the development of collection would be the retail and manufacturing industries producing and marketing the flexible packaging itself. Increasing extended producer responsibility (EPR) and packaging recycling obligations have the potential to drive investment into the waste supply chain to promote investment and maintenance of collection and treatment programmes and in particular collaborative work between the producing manufacturers/retailers.

Broadly speaking therefore there are a number of key steps in establishing viability of collection and treatment systems/infrastructure for this material, including:

- A positive standalone business case driven by reduced disposal cost, recycling market revenues and waste target benefits in terms of increased recycling/reduced disposal.

- Suitability of and access to waste collection and treatment systems (i.e. not all current sorting infrastructure may be equally suited and different levels of additional investment would be needed).
• Sufficient sustainable profitability for businesses at each stage of waste handling and treatment.

• Sufficient market stability to enable investment.

• Drivers for producers of packaging to invest in the collection and processing supply chain for the material potentially through collaboration.
6 Appendices

The following appendix documents have been provided as separate documents:

- Appendix 1: Pre-sort method statement
- Appendix 2: Communications protocol
- Appendix 3: Communications workshop presentation
- Appendix 4: Communications plan
- Appendix 5: Focus group material and communication materials
- Appendix 6: Total Ion Chromatogram (TIC) of recovered oil
- Appendix 7: dissemination plan