

Options for Reducing Emissions of Pre-production Plastic Pellets, Powders and Flakes

Report for Fidra

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Executive Summary

The aims of this study are to:

- 1) Explore potential options for reducing emissions of pre-production plastics; and
- 2) Make recommendations as to which options should be adopted, and who should take the lead on their implementation.

Current efforts to reduce emissions of pre-production plastics are led by industry bodies and NGOs. However only a small number of companies have signed up to the industry-led voluntary scheme, called Operation Clean Sweep. The potential to reach every company is complicated by the large number of small operators that are not members of industry bodies and thus potentially less likely to be influenced through these channels.

Furthermore, there are concerns about the lack of independent auditing and reporting in Operation Clean Sweep. This makes it difficult to determine the impact of actions taken to prevent spills and also raises questions as to the confidence that can be placed in the effectiveness of the scheme. Independent auditing could be incorporated into the scheme but the associated costs may act as a disincentive for new companies to join. Other approaches to improve uptake of best practice measures are therefore required that address a larger section of the plastics industry and offer a greater incentive for compliance.

Through analysing the plastics supply chain, the structure of the industry, and potential sources of emissions, this study assesses the potential for enhanced voluntary measures and regulatory intervention.

Based on the findings of this study, we make the following key recommendations:

- 1) Government should, as a priority, more fully investigate the potential for implementing regulatory measures to prevent the loss of pre-production plastics, building on the initial research presented in this report. Of key importance in this regard is to determine whether Waste Duty of Care under the Environmental Protection Act can be used as a means to require those who handle pre-production plastics to take all reasonable steps to prevent the escape of pre-production plastics from their control;
- 2) At the same time, government should instruct industry (broadly defined) to develop its own proposals (enhanced voluntary measures (EVMs)) for tackling the issue, with the challenge from government being that industry should demonstrate that they could achieve equal or greater reductions in emissions of pre-production plastics than might be expected under a regulatory approach (if they want to avoid the implementation of, or reduce the coverage of, specific regulatory measures). As part of this:
 - a. Government should present the example of what could be achieved through the inclusion of a specific module alongside the BRC Global Standard for Packaging and Packaging Materials in terms of procurement

standards and suggest that other sectors and their associations (e.g. the Construction Products Association, which has a sustainability group that covers, amongst other things, green procurement) devise similar strategies.

- b. Industry should provide a timescale for the introduction of the enhanced voluntary measures. It should be possible for such EVMs to be implemented relatively quickly given that they won't require legislation.
- 3) Government should then decide where immediate regulatory action is needed in order to 'fill the gaps', and review the effectiveness of the EVMs once they're implemented in order to check whether further regulation is required. It is worth noting that if the majority of industry participants are implementing the EVMs, there should be widely held support for legislation to 'level the playing field' and ensure that those not implementing best practice measures are required to do so. Such regulatory action could comprise:
 - a. Enforcing existing legislation, potentially using one or more test cases to determine the action that regulators must take; and/or
 - b. Creating new legislation specifically to tackle the loss of pre-production plastics.
- 4) Finally, there is a strong argument that Government should more fully apply the precautionary principle when it comes to measures to prevent the 'leakage' of plastics into the environment. While our knowledge on the impacts on the environment and human health, and the costs associated with these impacts, is far from complete what we do know is that the more we find out, the worse things seem. With no reason to suggest that future research will lead to reduced cause for concern, we feel there is merit in taking strong action now - within the bounds of reasonable costs - to prevent, to the extent possible, further losses of plastics (of all sizes) to the terrestrial and aquatic (freshwater and marine) environments.

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1.0 Introduction

The aims of this study are to:

- 1) Explore potential options for reducing emissions of pre-production plastics¹; and
- 2) Make recommendations as to which options should be adopted, and who should take the lead on their implementation.

Any proposed approach to addressing emissions of pre-production plastics should:

- 1) Be ambitious but achievable;
- 2) Be able to reach most, if not all, companies at risk of emitting pre-production plastics into the wider environment;
- 3) Be effective in tackling emissions of pre-production plastics at individual sites and across industry as a whole;
- 4) Not be disproportionately expensive;
- 5) Be fair, and be seen to be fair, to different actors within the industry; and
- 6) Allow for results on progress to be measured and publically reported.

On that basis, the options developed have been assessed in terms of:

- Feasibility;
- Comprehensiveness of coverage;
- Potential for impact;
- Indicative scale of costs and the distribution of costs – i.e. upon whom they fall;
- Cost-effectiveness - i.e. the anticipated cost in achieving a unit reduction in emissions of pre-production plastics for each option;
- Fairness, and perceived fairness; and
- Ability to monitor and report upon progress in a meaningful way.

The research is presented in the following sections:

- **Section 2.0** – Relevant background to the plastics supply chain, industry structure and the issue of emissions of pre-production plastics;
- **Section 3.0** - An overview of current efforts to address this issue;
- **Section 4.0** – Exploring a regulatory approach in the following stages:
 - **Section 4.1** – Introducing the focus and scope of the research into regulatory measures;
 - **Section 4.2** – Summarising existing regulations;
 - **Section 4.3** – Outlining the role of the environmental regulator;

¹ In this report we use the term ‘pre-production plastics’ to cover pellets, powders and flakes used in the production of plastic items.

- **Section 4.4** – Describing the current approach to regulation of the plastics industry;
- **Section 4.5** – Providing an overview of the regulation of drainage and water discharges;
- **Section 4.6** – Presenting a number of specific opportunities for intervention using current legislation
- **Section 4.7** – Presenting a Californian case study of permit-based legislation specifically designed to tackle pre-production plastics emissions;
- **Section 4.8** – Considering the feasibility of controlling emissions of pre-production plastics through permitting in the UK;
- **Section 4.9** – Presenting a summary of the key opportunities for regulatory intervention
- **Section 5.0** – Identifying where the greatest gains may be found from an industry-led voluntary approach; and
- **Section 6.0** – Recommendations for action based on this research.

2.0 Background

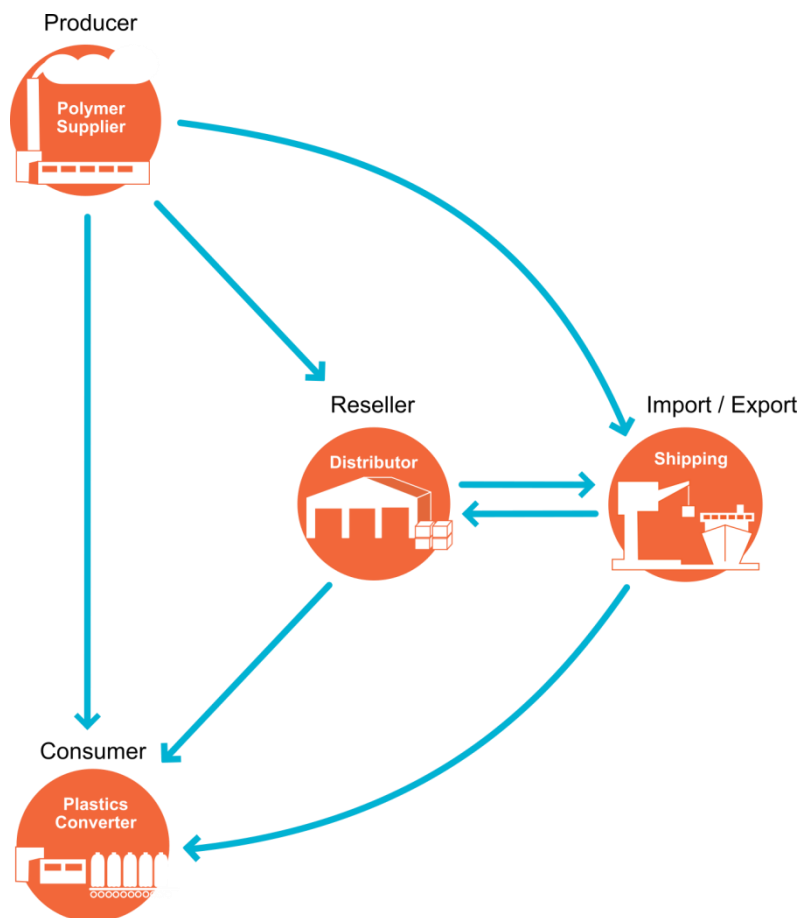
2.1 Plastics Supply Chain and Industry Structure

In order to identify and assess the options it is important to understand the plastics industry and the different actors within it. Not all actors will be influenced equally by any given course of action, and so insight into the structure of the industry and supply chain is necessary to assess the likely coverage and potential impact of the different options.

The supply chain for pre-production plastics starts with polymer suppliers. These organisations create pre-production plastics, including pellets, flakes and powders, through the process of polymerisation. Plastics converters are the consumers of pre-production plastics which they melt to reform in the manufacture of plastic goods. As shown in Figure 1, some pre-production plastics material is delivered directly from polymer suppliers to plastics converters. The larger plastics converters often buy from polymer suppliers in this way.

Distributors act as resellers and can stock a range of pre-production plastics from more than one polymer supplier. There is also an international trade in pre-production plastics. Larger quantities of material are transported on cargo ships and are transferred to road and rail at container ports for onward transport. Within the UK, haulage is performed by a third party under contract unless the plastics companies operate their own vehicles.

Figure 1: Movement of Pre-Production Plastics



The British Plastics Federation (BPF) reports the following key figures on the UK Plastics Industry:²

- 6,200 companies in the plastics industry;
- 5,200 manufacturers of plastic products;
- 1.7m tonnes of material produced (from UK-based polymer suppliers);
- 3.3m tonnes of plastic material processed at plastic converters; and
- £23.5 billion plastic industry turnover.

The ONS reports a similar number of businesses engaged in the plastics industry and provides further detail on the types of business involved and the industry structure. A breakdown of the market by the type of product made is shown in Figure 2. According to this data only 380 companies are involved in the manufacture of plastics in primary forms (polymer suppliers) and the other types of company in the data represent plastic goods manufacturers (plastics converters). The product market appears to be relatively diverse with the largest number of businesses classified as manufacturing ‘other plastic products’, presumably because the other Standard Industrial Classification (SIC) codes do

² BPF Members’ Directory 2016

not describe the nature of their product. After this 'other' category, the manufacture of products for the construction industry is the biggest category of businesses.

Figure 2: Number and Type of Business Enterprises Categorised using Plastics Production and Manufacturing SIC Codes³

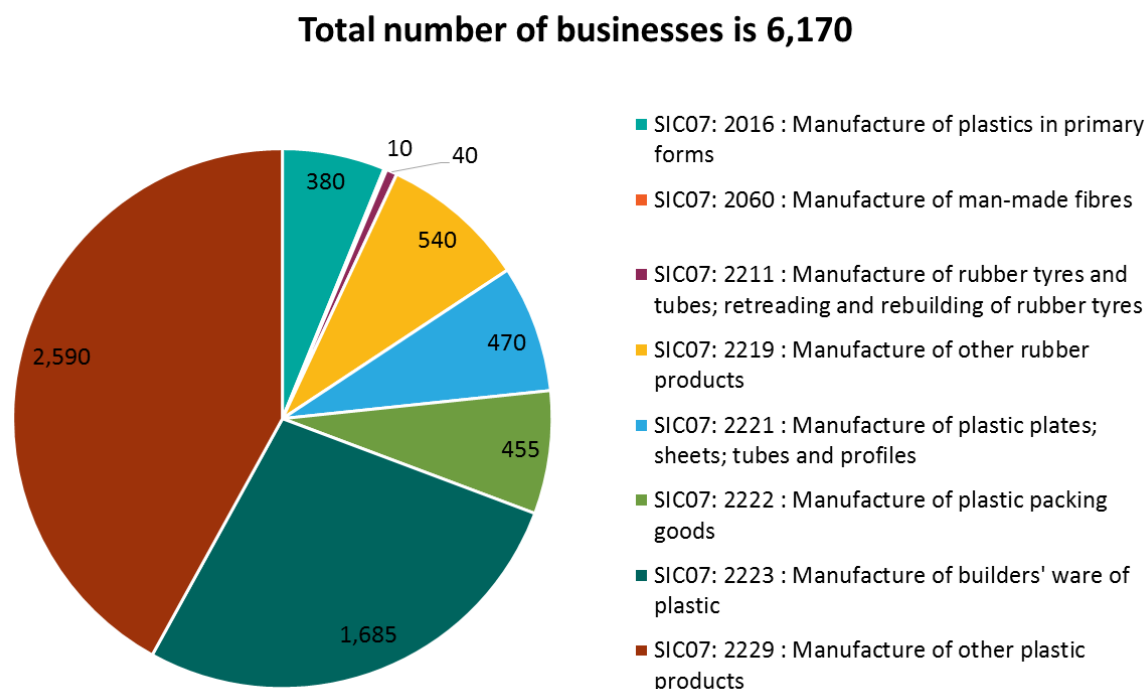


Figure 3 shows that the UK plastics industry includes a large number of companies with a relatively small annual turnover, as roughly half of businesses are in the bracket of £0 - £0.5 million turnover. For polymer suppliers, a large turnover may be indicative of producing a large quantity of pre-production plastics material. For plastics converters,

³ Based on ONS data in 'UKBAGb Enterprise by 4 Digit SIC and Turnover size band' using 8 SIC codes relating to plastic production and manufacturing, available at http://web.ons.gov.uk/ons/data/web/explorer/dataset-finder/-/q/dcDetails/Economic/UKBAGb?p_p_lifecycle=1&_FOFlow1_WAR_FOFlow1portlet_dataset_navigation=datasetCollectionDetails

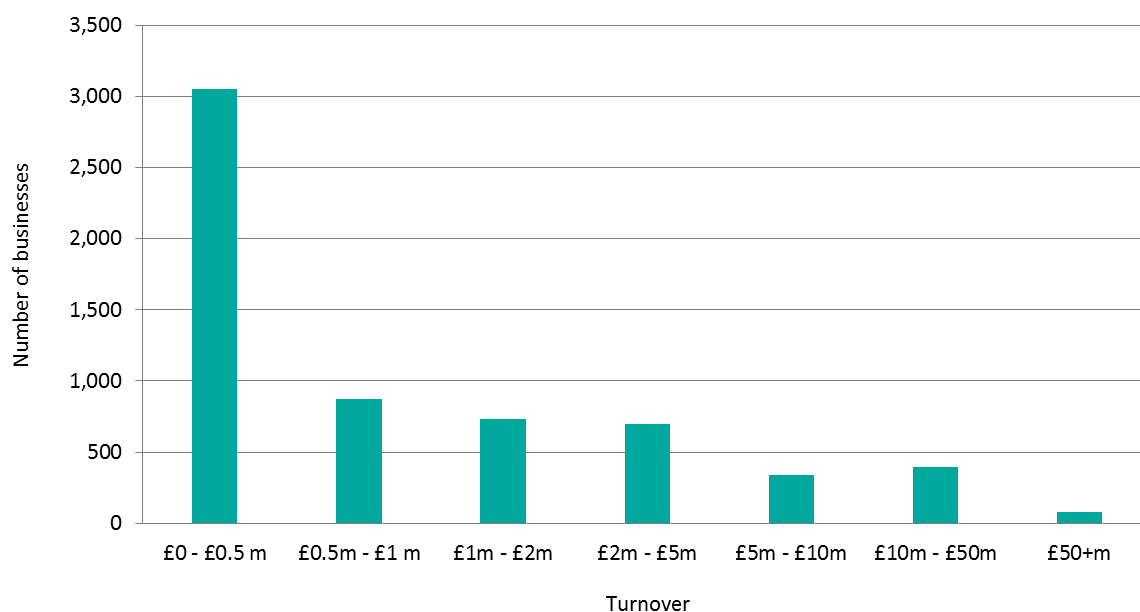
Note that another SIC code related to the 'Manufacture of synthetic rubber in primary forms' was included in the data but no companies were recorded against this code.

One SIC code is associated to each business unit recorded in statistical business registers, according to its principal economic activity. The principal activity is the activity which contributes most to the value added of the unit. For further information see: <http://www.siccodesupport.co.uk/>

A group of legal units under common ownership is called an Enterprise Group. An Enterprise is the smallest combination of legal units (generally based on VAT and/or PAYE records) which has a certain degree of autonomy within an Enterprise Group. An individual site (for example, a factory or shop) in an enterprise is called a local unit. For more information on the ONS methodology see: <https://www.ons.gov.uk/businessindustryandtrade/business/activitysizeandlocation/methodologies/ukbusinessactivitysizeandlocationmethodology>

pre-production plastics may constitute only one of many materials in their manufacturing process, and a lot of the value added is likely to be derived from the design and marketing of their products, and so turnover may not be indicative of the quantity of plastics material handled.

Figure 3: Structure of the UK Plastics Industry using Plastics Production and Manufacturing SIC Codes⁴

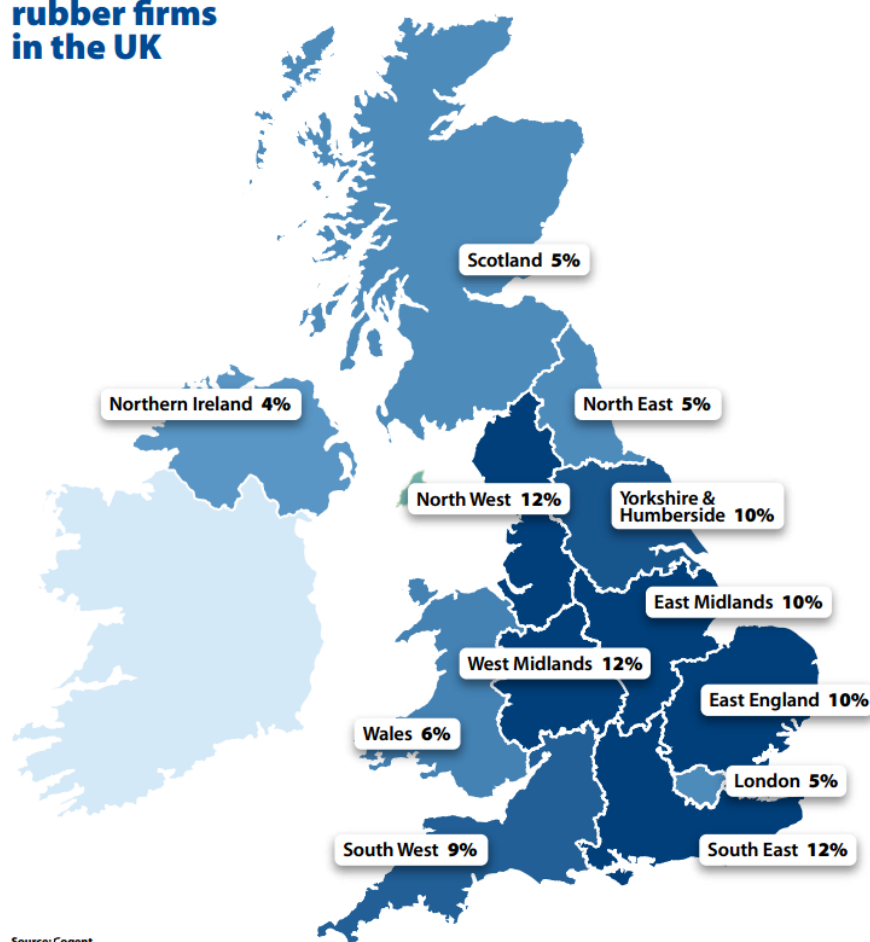


Plastics and rubber firms are fairly evenly distributed within the regions of the UK shown in Figure 4. Disaggregated data on the location of individual facilities would be useful to effectively target monitoring efforts, but no such dataset was found during this study.

⁴ Based on ONS data 'UKBAGb Enterprise by 4 Digit SIC and Turnover size band' using 8 SIC codes relating to plastic production and manufacturing. Turnover is based on VAT returns for a 12 month period for the majority of traders. For more information on the ONS methodology see: <https://www.ons.gov.uk/businessindustryandtrade/business/activitysizeandlocation/methodologies/ukbusinessactivitysizeandlocationmethodology>

Figure 4: Location of Plastics and Rubber Firms in the UK⁵

Location of plastics and rubber firms in the UK



Prices of 'a basket of' polyolefin polymers, which include PE (also LDPE, LLDPE, HDPE) and PP, reached £1,200 /tonne in November 2016.⁶ Whilst it is recognised that no operator would wish to lose any of this valuable feedstock it has been shown that there are diminishing returns in cleaning up spilt plastics material which means that there is insufficient economic incentive to safeguard every last particle on this basis alone.⁷

2.2 Sources of Emissions

There have been no comprehensive studies in the UK to determine the source of pre-production plastics that are found in the marine environment. Experience derived from inspections of facilities in the US and guidance in the Operation Clean Sweep (OCS)

⁵ BPF Members' Directory 2016 – based on numbers of firms

⁶ Plastrubution (2016) Price Know-How, November 2016, http://www.plastrubution.co.uk/wp-content/uploads/2016/09/PLB_Sales_Brochure-1.pdf

⁷ Eunomia (2016), Study to Quantify Pellet Emissions in the UK

Manual suggests the following points in the supply chain and handling of pre-production plastics where the risk of the material entering the wider environment is greatest:⁸

- **General handling**
 - Weak packaging breaks or develops punctures.
 - Transferring loose material if the system is not completely sealed and well-maintained, e.g. use of vacuum systems from bulk containers to the production line.
 - Manual handling, such as unloading material from sacks into a hopper.
- **Waste Disposal**
 - Waste containers may be inappropriate for storing small particles, for example skips have holes in the bottom to allow rainwater to escape.
- **Transport**
 - Cleaning vehicle – plastics material carried away in water used to wash vehicle.
 - Loading/sealing vehicle - plastics material spilled from loading equipment.
 - Storage at intermediate sites - vandalism leads to spills of plastics material.
 - Unloading bulk containers - surges in unloading lines cause plastics material to be vented into the environment.
- **Shipping**
 - Containers lost at sea.
 - Bags of pre-production plastics damaged during transit and leak from containers onto deck and into the ocean.
 - Spillage of plastics material due to packaging damaged during transit.
 - Spilt material swept straight into ocean.

It is also worth noting that plastics material spilled outdoors is generally considered high risk as:

- Spilt material is more difficult to locate and clean-up outdoors and on uneven surfaces;
- Spilt material is more likely to be scattered further if not cleaned up quickly as it is subject to wind and rain; and
- Housekeeping procedures are generally more rigorous inside facilities than outside due to the requirements of product manufacturing, particularly in the case of food grade packaging.

It is not clear, however, exactly where pre-production plastics enter the wider environment in the UK, or in what quantity; or even how much material is handled, by whom and where the greatest risk lies in the supply chain. Studies from various countries estimate the rate of material entering the wider environment to range from

⁸ Eunomia Research & Consulting (2016) Study to Quantify Pellet Emissions in the UK

0% to 1.0% of material handled, but are often based on very limited data. A study by Eunomia to quantify the scale of pellet emissions in the UK illustrated that large spills from shipping accidents attract newspaper headlines but the quantity lost each year on land is likely to be much greater.⁹ For terrestrial sources, there is no further information to draw upon to identify those most at risk of contributing towards emissions.

3.0 Current Efforts to Reduce Emissions of Pre-Production Plastics

The BPF is the main industry body for the plastics industry in the UK and has produced its own version of the OCS Manual and associated resources, which it promotes to its members. The BPF website states that:¹⁰

Operation Clean Sweep® is an international initiative from the plastics industry to reduce plastic pellet loss to the environment. In the UK it is led by the British Plastics Federation.

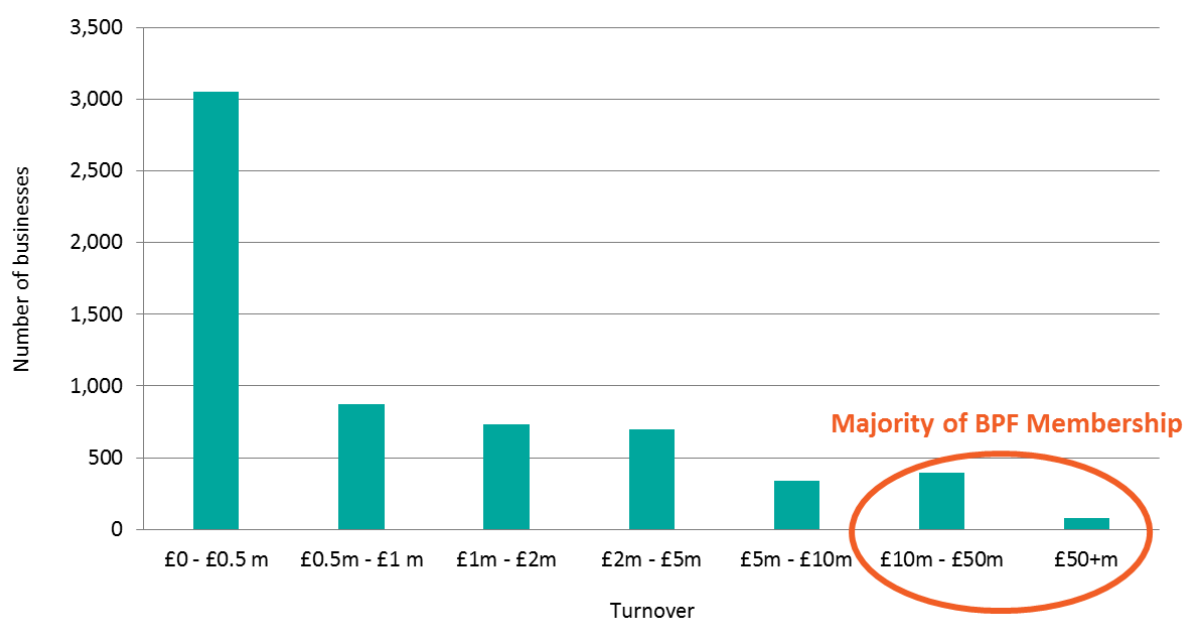
The BPF has approximately 550 members representing approximately 80% of the UK plastics industry by turnover.¹¹ The BPF membership therefore comprises around 9% of the total number of businesses in the UK plastics industry and must, in the most, part consist of the largest companies. It follows therefore that the other 91% of companies only constitute 20% of total industry turnover. This is broadly consistent with the view of the market structure provided by the ONS data, as illustrated in Figure 5. The BPF is therefore an important stakeholder in engaging the largest businesses in the UK plastics industry and also has influence beyond its membership base, but it must be recognised that there are also a large number of small operators, and others involved in the supply chain such as some logistics companies, that are potentially less likely to be influenced by communications from the BPF.

⁹ Eunomia Research & Consulting (2016) Study to Quantify Pellet Emissions in the UK

¹⁰ See http://www.bpf.co.uk/sustainability/operation_Clean_Sweep.aspx

¹¹ Personal communication with Helen Jordan, Sustainability Issues Executive, British Plastics Federation

Figure 5: BPF Members Represent 9% of Companies and approximately 80% of Industry Turnover ¹²



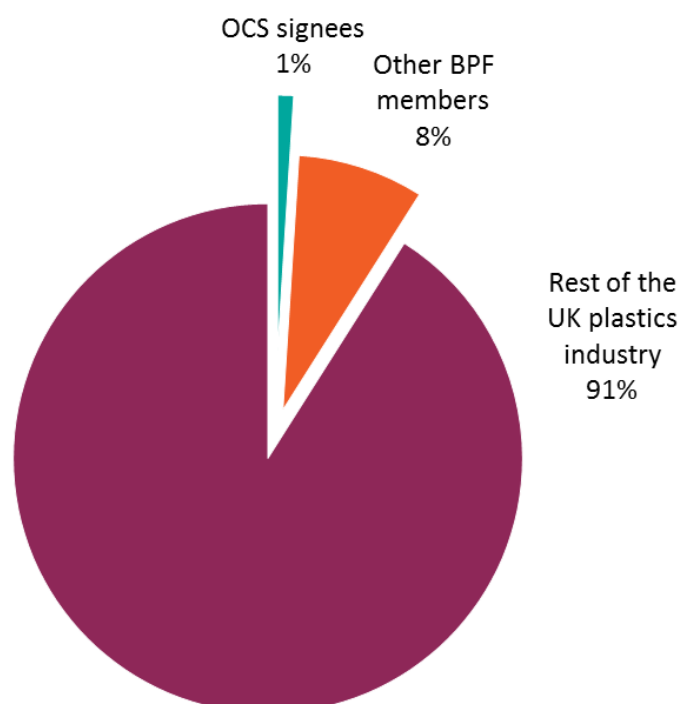
The BPF reports that currently 63 companies have signed up to OCS. The BPF OCS website reports that 57 of these companies are BPF members and 5 are non-members.¹³ This means that:

- Roughly **10% of BPF members are signed up to OCS**; and
- Only **1% of businesses in the UK plastics industry are signed up to OCS**.

¹² Based on ONS data 'UKBAGb Enterprise by 4 Digit SIC and Turnover size band' using 8 SIC codes relating to plastic production and manufacturing.

¹³ BPF Operation Clean Sweep, accessed 06/12/2016, http://www.bpf.co.uk/sustainability/operation_Clean_Sweep.aspx

Figure 6: Companies Signed Up to OCS and Members of the BPF



The BPF has worked to increase OCS membership in recent years, with over half of the OCS signees adopting the programme in the last two years.¹⁴ The BPF is also trying to establish the tonnage of material handled by the companies signed up to OCS.

To focus initial efforts on the companies handling the largest quantities of pre-production plastics would seem to be a logical approach. However, it is not clear whether there is a link between the quantity of pre-production plastics handled by a facility and the risk of material escaping to the wider environment. Larger companies, and polymer suppliers in particular, are likely to be more closely regulated due to the range of activities they undertake and the quantity of hazardous substances involved.

Accordingly, one might expect large companies and large facilities, in general, to have more modern equipment, better maintenance, better training, and stricter housekeeping procedures. Therefore, facilities handling larger quantities of plastics material may not necessarily pose the greatest risk as there may be less likelihood of material escaping. A similar situation was found in the US, where staff of the California State Water Resource Control Board reported that smaller facilities and those

¹⁴ Personal communication with Helen Jordan, Sustainability Issues Executive, British Plastics Federation

manufacturing lower value products were often the worst polluters of pre-production plastics.¹⁵

It is outside the scope of this study to assess the effectiveness of the OCS programme at reducing emissions of pre-production plastics in the companies that adopt it. However, this is currently seen as the main means to address the issue within the industry and is supported by both industry bodies and NGOs. The best-practice procedures contained within the OCS programme have been developed by industry operators, and facilities are encouraged to adopt OCS measures or implement their own as appropriate. It must therefore be assumed that if an operator wishes to reduce the escape of pre-production plastics from their site then OCS would provide useful guidance for them to follow. Potential concern over the effectiveness of OCS is therefore not directed at the best-practice measures promoted in OCS but at the lack of independent external auditing and transparent reporting and thus the true extent of the impact achieved.

The cost of adopting OCS varies depending on the site-specific needs and the measures chosen to address them. The best-practice measures outlined in OCS are designed to be low-cost and easy to implement, and some operators have chosen to make more expensive changes such as altering site drainage. Assuming that the necessary improvements are made to ensure the scheme is effective, the analysis above suggests that there is a great opportunity for reducing emissions of pre-production plastics by increasing take-up of the scheme in the UK.

Currently OCS is promoted in the UK through the efforts of industry bodies, most notably the BPF but also Plastics Europe, and the work of NGOs such as Fidra. This means that the burden of costs currently lies with funders of the NGOs and with members of the industry bodies, which for the BPF at least predominantly consists of the larger companies in the plastics industry. This raises the issue of fairness as the costs of tackling the issue should arguably be borne by the plastics industry as a whole. Furthermore, only 1% of companies are signed to OCS and are likely therefore to be incurring costs of implementing best-practice that their competitors, who have not put in place best practice measures, are not.

In promoting OCS, the BPF currently focuses efforts on actively engaging companies in its membership.¹⁶ However, its OCS programme is also open to non-members and the associated resources on the website are available for anyone to use. The BPF also uses a number of communication channels that would reach non-members as well as members, including seminars, articles in trade press, contacting its affiliate members and encouraging communication with the wider supply chain. The coverage of current efforts is therefore difficult to determine with accuracy, although members of the BPF are much more likely to be reached and influenced by these efforts than non-members.

¹⁵ Personal communication with Dylan Seidner for the report Eunomia Research & Consulting (2016) Study to Quantify Pellet Emissions in the UK.

¹⁶ Personal communication with Helen Jordan, Sustainability Issues Executive, British Plastics Federation

The OCS materials suggest operators establish an inspection and enforcement system, for example by requiring every employee to complete a fortnightly inspection form documenting spills and the containment measures taken. However, as with other actions suggested in OCS these measures are voluntary and there are no requirements for auditing or reporting under OCS. This makes it difficult to estimate the impact of OCS in its current form. The BPF does seek to continue to engage companies after they have signed OCS and has conducted a survey to understand the measures taken under OCS, which should go some way to understanding the impact achieved.¹⁷

4.0 Regulatory Approach

4.1 Introduction

There are currently no regulations in the UK that directly address the issue of microplastics in the marine environment. A non-exhaustive search of relevant legislation is presented below to identify opportunities to regulate emissions of pre-production plastics under existing regulations. The mechanisms for monitoring, enforcement and cost-recovery are also explored. The basis for regulation to specifically control pre-production plastics is assessed by looking at similar legislation from California.

National legislation that appears to have the potential to be used to tackle emissions of pre-production plastics is highlighted below.

As with other regulatory frameworks, the structure and specific wording of environmental legislation differs between England and Wales, Scotland, and Northern Ireland. In the case of water quality, waste and pollution the legislation is often very similar as it stems from common roots, such as long-established Acts that have been adapted by devolved administrations or the implementation of EU Directives.

However, subtle differences in the wording of the regulations may prevent them from being used in the same manner. The examples of national legislation highlighted below are used to identify opportunities for regulatory intervention, but it would require a full legislative review to give proper consideration to the legislative framework of each nation. Similarly, the organisations tasked with enacting the regulation, the environmental regulators, perform similar functions in each country but there are differences in powers, responsibilities, and approach that would impact upon any regulatory option. Therefore, illustrative examples are given for specific countries but these cannot necessarily be assumed to be the same throughout the UK.

The rest of this section is laid out as follows:

- Section 4.2 presents a summary of existing regulation;

¹⁷ Personal communication with Helen Jordan, Sustainability Issues Executive, British Plastics Federation

- In Section 4.3 the role of the environmental regulator is introduced;
- The current approach to regulation of the plastics industry is described in Section 4.4;
- In Section 4.5 an overview is provided of the regulation of drainage and water discharges;
- In Section 4.6 we present a number of specific opportunities for intervention using current legislation;
- Section 4.7 presents a Californian case study of permit-based legislation specifically designed to tackle pre-production plastics emissions; and
- Section 4.8 considers the associated issues with controlling emissions of pre-production plastics through permitting in the UK.

Section 4.9 presents a summary of the key opportunities for regulatory intervention.

4.2 Summary of Existing Regulation

The potential for regulation of pre-production plastics using existing European and national regulation is assessed below. As no regulation currently exists specifically to address emissions of pre-production plastics a broad range of regulation was considered, which was selected based on the nature of the material itself, the environments in which it is found and the activities associated with its handling. A summary is shown in Table 1 and further detail on the Marine Strategy Framework Directive, Water Framework Directive, and Industrial Emissions Directive is provided in Appendix A.1.0.

Table 1: Summary of Existing Regulations

Legislation	Application to Emissions of Pre-Production Plastics
Waste Duty of Care Code of Practice (Environmental Protection Act (EPA) 1990 s34 and associated Code of Practice)	There is a strong case that any pre-production plastics entering the environment would constitute a criminal offence under these regulations. This is explained in detail in Section 4.6 and Section 4.6.2.
Water Resources Act and Environmental Permitting Regulations, England and Wales	Similarly, there is a strong case that these regulations could be applied where pre-production plastics enter a watercourse. This is explained in in Section 4.6.3.

Legislation	Application to Emissions of Pre-Production Plastics
Statutory Nuisance (EPA 1990 s79)	These regulations are unlikely to apply at the moment because the link between microplastics and harm to human health would need to be established in this context. ¹⁸ However, there is a possibility to explore the application of the definition of nuisance as ‘an unreasonable reduction in amenity or environmental quality in a way common to several people at once’. ¹⁹ This could be the case in terms of the high numbers of pre-production plastics found on specific beaches, and this argument has been applied in respect of discarded plastic cotton bud sticks that end up on beaches. ²⁰
Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)	These regulations do not apply as all polymers are currently exempt from registration and evaluation under REACH. ²¹ Furthermore, the risk to human health or the environment would need to be demonstrated to the Risk Assessment Committee of the European Chemicals Agency before a substance becomes subject to restriction. ²²
European Regulation on Persistent Organic Pollutants (POPs)	These regulations are unlikely to apply. Although plastics are thought to be vectors for POPs, these regulations are designed to control emissions of POPs themselves rather than the interactions with other materials once emitted.
Health and Safety at Work etc. Act 1974	These regulations apply only so far as to protect employees from, for example, the risk of slips and trips, but most of the pathways for pre-production plastics to escape do not necessarily pose a health and safety risk.

¹⁸ For the issue to count as a statutory nuisance it must do one of the following: (A) unreasonably and substantially interfere with the use or enjoyment of a home or other premises, or (B) injure health or be likely to injure health. See: <https://www.gov.uk/guidance/statutory-nuisances-how-councils-deal-with-complaints>

¹⁹ Chartered Institute of Environmental Health (2017) Statutory Nuisance webpage, available at <http://www.cieh.org/policy/environmental-protection/statutory-nuisance.html>

²⁰ See <http://www.isonomia.co.uk/?p=3019>

²¹ *Polymer and REACH Regulation | CIRS*, accessed 7 December 2016, http://www.cirs-reach.com/REACH/Polymer_REACH_CLP.html

²² HSE (July 2016), UK REACH Competent Authority Information Leaflet Number 20 – Restrictions <http://www.hse.gov.uk/reach/resources/20restrictions.pdf>

Legislation	Application to Emissions of Pre-Production Plastics
Producer Responsibility	These regulations do not apply. Producer responsibility regulations aim to make businesses that manufacture, import and sell these products responsible for their end of life environmental impact in formal waste management services, rather than preventing a relatively small quantity of manufacturing feedstock escaping. ²³
Marine Strategy Framework Directive (MSFD)	These regulations do not currently apply as DEFRA concluded there was insufficient understanding of the harm caused by microplastics. However, DEFRA is supporting further research into microplastics in the marine environment which could lead to monitoring programmes and targets as part of the implementation of the MSFD. (See Annex A.1.1)
Water Framework Directive (WFD)	These regulations do not apply unless microplastics are characterised as a priority substance by demonstrating the intrinsic hazard posed and the level of contamination is evidenced by monitoring. (See Annex A.1.2)
Environmental Quality Standards Directive (EQS)	These regulations do not apply unless microplastics are included in the list of pollutants which, alongside the priority substances defined in the WFD, are controlled by limit values that must be met to achieve good environmental status under the MSFD.
Industrial Emissions Framework Directive	<p>These regulations do not apply to the escape of pre-production plastics but are the primary means through which the industrial processes of polymer suppliers are regulated by setting permit conditions that are managed and enforced by the environmental regulator. The conditions are primarily concerned with emissions from industrial processes rather than the accidental loss of raw material. However, Best Available Techniques for each activity covered by the IED are established in BAT Reference documents, developed in collaboration with government, industry, NGOs and other stakeholders.</p> <p>This could be a good model to follow for the widespread adoption of best-practice measures for control of pre-production plastics. (See Annex 0)</p>

²³ *Producer responsibility regulations* - GOV.UK, accessed 7 December 2016, <https://www.gov.uk/government/collections/producer-responsibility-regulations>

As understanding of the impacts of microplastics on specific species improves it may also be appropriate to consider other legislation such as that related to the Birds Directive (Council Directive 2009/147/EC), the Habitats Directive (Council Directive 92/43/EEC), and parts of the Water Framework Directive relating to fish waters and shellfish waters.

The Environment Agency recently clarified that it does not explicitly consider microplastic in its environmental permits that control the discharge of liquid effluent or waste water to surface water or onto the ground.²⁴ As outlined above, there is currently no specific mention of plastics or microplastics as a pollutant in EU or national legislation. If plastics were determined to be a pollutant then many of the current EU Directives and national regulations outlined in Table 1 could in theory be applied to regulate it.

There is currently no common definition of pollution used in the regulations. The Water Framework Directive adopts the following definition, which is one of the more detailed descriptions:²⁵

‘Pollution’ means the direct or indirect introduction, as a result of human activity, of substances or heat into the air, water or land which may be harmful to human health or the quality of aquatic ecosystems or terrestrial ecosystems directly depending on aquatic ecosystems, which result in damage to material property, or which impair or interfere with amenities and other legitimate uses of the environment.

Other regulations use different definitions of pollution but typically include the central idea of ‘harm to the environment or human health’. There is growing evidence on the impact of microplastics on the environment in general, and the UK Government has recently announced that the Chief Medical Officer will review the impact on human health of microplastic pollution.²⁶ As our understanding grows, this may in due course lead to the inclusion of microplastics in lists of substances to be controlled through legislation.

However, when it comes to plastics in the marine environment – an area about which relatively little is known – it seems that with alarming frequency, new academic studies are published warning of yet further ways in which human actions are leading to negative impacts. While we don’t know the full cost of these impacts, it is clear that the

²⁴ Environment Agency (2016), written evidence provided to the Environmental Audit Committee’s inquiry into the Environmental impact of microplastics, July 2016, <http://data.parliament.uk/WrittenEvidence/CommitteeEvidence.svc/EvidenceDocument/Environmental%20Audit/Environmental%20impact%20of%20Microplastics/written/34812.html>

²⁵ European Commission (2000) Water Framework Directive: Establishing a Framework for Community Action in the Field of Water Policy

²⁶ UK Parliament (2016) Chief Medical Officer to review human health impact of microplastic pollution, Environmental Audit Committee News, 14 November 2016, available at <https://www.parliament.uk/business/committees/committees-a-z/commons-select/environmental-audit-committee/news-parliament-2015/microplastics-government-response-16-17/>

more we learn, the more serious they seem, and there is nothing to suggest that future research findings will lead to reduced cause for concern. Accordingly, as argued in a recent Eunomia report, a strong case can be made that the precautionary principle should be applied, and all reasonable measures should be implemented to prevent plastics entering the marine environment.²⁷

Such a view is not in evidence from the UK Government. Defra has previously stated that further work is needed to better understand marine litter and its impacts. This may be true, but it need not be a justification for inaction. Defra is putting in place monitoring programmes and states that:²⁸

“Once the extent of the problem is better understood we will be able to assess the need for any additional measures”.

Any regulation relating to pre-production plastics would ultimately be enforced by the environmental regulator, whose role and the approach they might take is outlined in Section 4.3 below.

4.3 Role of the Environmental Regulator

The main environmental regulators in the UK are the Environment Agency (England), Natural Resources Wales (Wales), the Scottish Environment Protection Agency, and the Northern Ireland Environment Agency. If emissions of pre-production plastics were to be controlled by legislation (and they arguably should be under Waste Duty of Care, explained in Section 4.6.2) then it is these organisations that would be responsible for monitoring and enforcement. This would be likely, in the first instance, to involve engagement with a site operator to raise any issues and support them where needed in taking corrective action, as demonstrated in a statement on enforcement by the Environment Agency:²⁹

We regard prevention as better than cure. Our general approach is to engage with business to educate and enable compliance. We offer information and advice to those we regulate and seek to avoid bureaucracy or excessive cost. We encourage individuals and businesses to put the environment first and to integrate good environmental practices into normal working methods. We will give proper consideration to the value of economic progress.

If an operator or individual is not complying, we normally provide advice and guidance to help them do so. Where appropriate, we agree solutions and

²⁷ Eunomia Research & Consulting (2016) Measures to Prevent Marine Plastic Pollution, available at <http://www.eunomia.co.uk/reports-tools/measures-to-prevent-marine-plastic-pollution/>

²⁸ HM Government (2015), *Marine Strategy Part Three: UK programme of measures*, December 2015, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/486623/marine-strategy-part3-programme-of-measures.pdf

²⁹ The Environment Agency (2014), *Enforcement and sanctions statement*, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/389348/LIT_5197.pdf

timescales for making any improvements. We try to match our response to the circumstances. The use of formal enforcement powers and sanctions may also be necessary.

Furthermore, the Environment Agency seeks to recover all costs from those responsible incurred through investigation, enforcement proceedings, and remedial works, in accordance with the 'polluter pays' principle.³⁰ The burden of the costs will therefore fall upon facility operators, and those who require the most engagement will pay the highest charges.

There are many enforcement responses available to the Environment Agency, including assistance, guidance, warnings, enforcement notices, orders and remediation powers, and criminal sanctions (fixed penalty notices, formal cautions, prosecution, etc.). The types of sanctions that can be used vary for each offence. In some cases a civil sanction can be applied under the Regulatory Enforcement and Sanctions Act 2008, which allows stronger sanctions to be used without going to court, thereby reducing the cost and associated burden of proceedings.

The powers and activities of the environmental regulator results from conditions and regulations set in legislation. In Section 4.4 we explore how different legislation applies to different types of company in the plastics industry according to the activities they undertake.

4.4 Current Regulation of the Plastics Industry

Industrial and manufacturing facilities are, for the most part, regulated based on the risk posed by the activities undertaken. With respect to the plastics industry, polymer production is specifically regulated under the Industrial Emissions Directive. The emission limits established in this Directive are used to define conditions within the permits issued by the environmental regulator. The IED Best Available Technique Reference documents (BREFs) also outline the techniques that should be employed to minimise the risk of environmental harm associated with the activities covered.

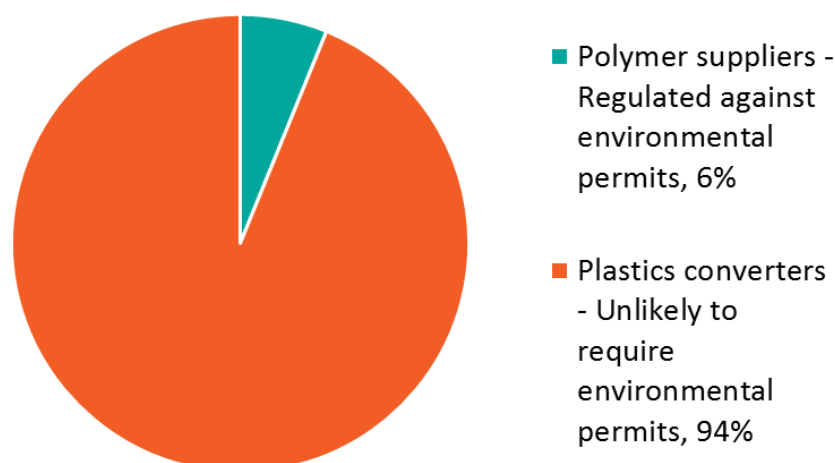
This means that polymer suppliers, which represent 6% of companies in the UK plastics industry, require permits that control industrial activities undertaken at each of their sites. This requires contact with the environmental regulator, for example when reporting against the permit conditions or through inspection activities. The current Production of Polymers BREF does not include any consideration of best available measures to prevent the loss of pre-production plastics.³¹ However, this BREF is due to be revised, and there is thus an excellent opportunity to use this revision to ensure such measures are included.

³⁰ The Environment Agency (2014), *Enforcement and sanctions statement*, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/389348/LIT_5197.pdf

³¹ See JRC (2017) Reference Documents under the IPPC Directive and the IED, available at <http://eippcb.jrc.ec.europa.eu/reference/>

Plastics converters on the other hand are unlikely to be regulated under the IED as melting pre-production plastics to form into new products does not necessarily require the use of hazardous substances or emissions to air, water or ground. Plastics converters, which represent 94% of companies in the UK plastics industry, are therefore less likely to have contact with the environmental regulator. The expected level of environmental permitting in the plastics industry under the IED is summarised in Figure 7.

Figure 7: Likely Level of Environmental Permitting in the UK Plastics Industry under the Industrial Emissions Directive



Plastics recyclers are subject to waste regulations which determine the conditions of site permits managed by the environmental regulator. The Environment Agency and other environmental regulators allocate considerable resources to monitoring and enforcement of the waste management sector, and operators often have close contact with permitting and inspection teams. It is therefore worth noting that plastics recyclers are likely to be more closely regulated than converters, although both have the potential for plastic flakes (in the case of recyclers), powders and pellets to enter the environment.

Accordingly, the future revision of the production of polymers BREF is a good opportunity to require best practice measures to be implemented by polymer producers. However, converters are less likely to be regulated under Environmental Permitting, and thus there is far less potential for using this route to tackle the loss of pre-production plastics among this part of the industry.

4.5 Regulation of Drainage and Water Discharges

One of the ways in which pre-production plastics are thought to enter the marine environment is by being washed into drains. Surface water drains are designed to transport uncontaminated surface water, such as rain water, and discharge directly into watercourses without any treatment of the water. Foul water drains are designed to transport sewage, trade effluent and other contaminated water to waste water treatment plants where the water is treated to meet a certain quality standard before it

is discharged into a watercourse. Combined drains take both surface water and foul water, which mix together and are transported to a waste water treatment plant. Often combined sewer systems have an overflow that discharges water directly into a watercourse before it is treated to prevent the system being overloaded in the case of heavy rainfall. The regulatory regime to control water discharges in the UK is well-developed and is enacted through the interaction of the environmental regulator and the water industry. The potential to control emissions of pre-production plastics through these means is explored below.

In England and Wales the Environmental Permitting Regulations (EPR) 2010 control all discharges to controlled waters except groundwater, for discharge activities covered by the Water Resources Act and relevant EU Directives such as the WFD.³² Under these regulations, discharges of polluted water, trade effluent and waste are controlled by environmental permits issued and managed by the Environment Agency. It is important to note that, a permit is not required for the discharge of uncontaminated surface water as this is not considered a water discharge activity.

Water discharges to foul sewers are controlled by the water industry, which in turn is regulated by the environmental regulator to control the discharge of water from waste water treatment plants. Sewerage companies issue trade effluent consents to commercial customers to control effluent entering their waste water treatment plants and it is a criminal offence to exceed the limits and conditions set. The conditions are used to prevent the waste water treatment plants from being overloaded and to maintain the standard of water leaving the sewage treatment plant. Sewerage companies cannot impose conditions on trade effluent that the environmental regulator has not used in the discharge consent for the treatment plant, and so it would require changes to the relevant legislation for new conditions to be imposed upon trade effluent.

The presence of pre-production plastics would be controlled by limits concerning 'suspended solids'. However, these limits are typically set at a level which would permit a considerable concentration of pre-production plastics to be emitted without exceeding the permit conditions.^{33 34}

It is unlikely that a facility would apply for an environmental permit or a trade effluent consent specifically for the event that spilt material may accidentally or unknowingly enter surface water drains or foul sewerage. It is therefore possible that many plastics

³² Defra (2010), *Environmental Permitting Guidance Water Discharge Activities, For the Environmental Permitting (England and Wales) Regulations 2010*, December 2010, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69345/pb13561-ep2010waterdischarge-101220.pdf

³³ Ditte, G. (2015) *Trade effluent consent conditions*, accessed 16 December 2016, <http://www.wessexwater.co.uk/Business/Sewerage/Trade-effluent-consent-conditions/>

³⁴ Personal correspondence with Mark Craig, Severn Trent Water.

facilities do not have permits to control discharges of water where they do not discharge trade effluent water as part of their manufacturing process.

It is thought that pre-production plastics entering sewage treatment plants would be removed during tertiary solids removal (where this is available) or, assuming the material floats, it would be collected with other material from the surface of the water during the settlement treatment stage, known as scum removal.³⁵ Whilst it is important to consider the fate of microplastics entering waste water treatment plants, in the case of pre-production plastics it is undoubtedly more cost-effective to address the issue at source rather than trying to implement end-of-pipe measures. Importantly, even if captured within sewage sludge, they may then be applied to land, which could also have negative impacts.

Trade effluent consents do not appear, at present, to have much potential to be used to prevent the loss of pre-production plastics. There are, however, opportunities to regulate emissions using other forms of existing legislation, as explained in Section 4.6 below.

4.6 Specific Opportunities for Intervention under Current Legislation

The following specific opportunities for regulatory intervention are explored below:

- Classifying pre-production plastics as waste (Section 4.6.1):
- Given that the evidence suggests that spilt pre-production plastics *are* classified as waste, how Waste Duty of Care legislation might be used to either enforce, and/or preferably encourage adoption of best practices (Section 4.6.2); and
- The potential for determining emissions of pre-production plastics to water as an offence under the relevant Regulations (Section 4.6.3).

4.6.1 Pre-Production Plastics Classified as Waste

Pre-production plastics spilt on the floor or otherwise escaping the owner's control are arguably a waste material. If they are legally classified as waste then waste regulations apply and could be used to regulate companies that fail to prevent their escape. In order for spilt pre-production plastics to be recognised as waste by the relevant regulators (EA/SEPA/NRW/NIEA), it is likely that a test case would be required. However, an initial step could be for an NGO to raise the issue with the regulator(s) and seek clarification from them.

³⁵ Personal correspondence with Mark Craig, Severn Trent Water and Andy Mears, Wessex Water.

Government guidance clarifies that a material is considered to be waste if it is, amongst other things:³⁶

accidentally, unknowingly or involuntarily discarded e.g. when a fuel is leaking from a service station storage tank into the ground beneath and the producer or holder is unaware of the leak

This description could be applied to most of the points at which the plastic material is thought to enter the wider environment (outlined in Section 2.0), and the example of a substance leaking from a storage tank has parallels to many of the issues of leaks of pre-production plastics during storage, waste containment, transport and transfer of material. The government guidance contains exceptions relating to specific materials and activities but none exclude the case of spilt pre-production plastics that then enter the wider environment. In this context the owner of the material or the person(s) employed to transport it are deemed waste producers, which is a type of waste holder, and as such they have certain responsibilities by law.

DEFRA further illustrates by way of case law that a substance or object discarded involuntarily and unknowingly is considered to be waste:³⁷

In the Van de Walle case the hydrocarbons that were accidentally spilled and which caused soil and groundwater contamination were held by the European Court to be waste even though no one knew at the time of the spill what was happening.

Spilt plastics material that is correctly collected and placed in waste containers for disposal or recycling is of course also considered to be waste, and any plastics material escaping waste containment could be regulated through waste regulations.

4.6.2 Waste Duty of Care Code of Practice

If spilt or otherwise discarded pre-production plastics are considered to be a waste material then any company that fails to prevent pre-production plastics from escaping into the wider environment is committing an offence under UK legislation known as the Waste Duty of Care Code of Practice.

Section 34 of the Environment Protection Act (EPA) (1990) sets out a number of legal duties with regards to the management of waste. These duties are known as the Waste Duty of Care. The subsequently issued Waste Duty of Care Code of Practice is admissible

³⁶ *Decide if a material is waste or not: general guide (updated version of part 2 of original full document)* - GOV.UK, accessed 7 December 2016, <https://www.gov.uk/government/publications/legal-definition-of-waste-guidance/decide-if-a-material-is-waste-or-not#decide-if-your-material-is-waste>

³⁷ DEFRA (2012), *Guidance on the legal definition of waste and its application*, August 2012, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69590/pb13813-waste-legal-def-guide.pdf

in court as evidence and therefore also forms part of the legal requirements relating to waste management. The Code of Practice states:³⁸

This Code applies to you if you import, produce, carry, keep, treat, dispose of or, as a dealer or broker have control of, certain waste in England or Wales.

Failure to comply with the duty of care is an offence subject to an unlimited fine on conviction. The Code is admissible as evidence in legal proceedings and its rules must be taken into account where relevant to questions raised in the case.

The Waste Duty of Care Code of Practice states that **waste holders must take all reasonable steps to prevent the escape of waste from their control**. Furthermore, failure to comply with the duty of care requirements is a criminal offence and could lead to prosecution. Waste Duty of Care Code of Practice documents define similar regulations for Scotland and Northern Ireland that could be applied in the same way.

Ideally, this would act as an incentive for firms to put in place best-practice measures. If best-practice measures have been followed correctly then any documentation of the steps taken to prevent the escape of waste from their control could be used as a legal defence to prosecution. This would most likely require a test case to test the application of the Waste Duty of Care for prosecution and establish what is needed to demonstrate that ‘all reasonable steps to prevent the escape of waste from their control’ have been undertaken.

4.6.3 Unpermitted Water Discharge Activity

Discharges of water are carefully regulated to protect the aquatic environment. Water discharge activities typically require a permit from the environmental regulator with a few exceptions such as discharges of uncontaminated surface water. The following section explores the regulations for water discharges and how they might be applied to regulate a facility that does not hold a permit to discharge water and that is found to be emitting pre-production plastics to a watercourse, for example via surface water drains.

Section 85 of the Water Resources Act (England and Wales) 1991 defines principal offences under the act, including if a person:³⁹

causes or knowingly permits any poisonous, noxious or polluting matter or any solid waste matter to enter any controlled waters.

Controlled waters are territorial waters (extending 3 miles out to sea), coastal waters, inland freshwaters and ground waters. The terms poisonous, noxious or polluting are not defined in the Act and are left to the interpretation of the courts. However, if spilt or

³⁸ DEFRA (2016) Waste Duty of Care Code of Practice, Report for Department for Environment, Food and Rural Affairs, March 2016, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/506917/waste-duty-care-code-practice-2016.pdf

³⁹ Water Resources Act (England and Wales) 1991, <http://www.legislation.gov.uk/ukpga/1991/57>

otherwise discarded pre-production plastics constitute solid waste matter, as argued above, then the regulations could be applied without the need for the material to be proven to be poisonous, noxious or polluting.

The Environment Agency or a private individual or association may bring prosecutions under Section 85. The penalties are set out in item six of the principal offences:

Subject to the following provisions of this Chapter, a person who contravenes this section or the conditions of any consent given under this Chapter for the purposes of this section shall be guilty of an offence and liable—

- a. on summary conviction, to imprisonment for a term not exceeding three months or to a fine not exceeding £20,000 or to both;
- b. on conviction on indictment, to imprisonment for a term not exceeding two years or to a fine or to both.

These regulations are mirrored in regulations 38(1) and 12(1) of the Environmental Permitting (England and Wales) Regulations (EPR) 2010, which make it an offence to cause or knowingly permit a water discharge activity unless you are complying with an environmental permit or exemption. Schedule 21 of the regulations defines a water discharge activity, which includes:

the discharge or entry to inland freshwaters, coastal waters or relevant territorial waters of any—

- i. poisonous, noxious or polluting matter,
- ii. waste matter, or
- iii. trade effluent or sewage effluent;

Penalties are defined in Section 39 of the EPR:

A person guilty of an offence under regulation 38(1), (2) or (3) is liable—

- a) on summary conviction to a fine not exceeding £50,000 or imprisonment for a term not exceeding 12 months, or to both; or
- b) on conviction on indictment to a fine or imprisonment for a term not exceeding 5 years, or to both.

In Scotland water discharge activities are regulated under the Water Environment (Controlled Activities) (Scotland) Regulations 2011, more commonly known as the Controlled Activity Regulations (CAR). The regulations make it an offence to undertake specific activities without a CAR authorisation, including:⁴⁰

the direct or indirect discharge, and any activity likely to cause a direct or indirect discharge, into groundwater of any hazardous substance or other pollutant;

Pollution is defined in terms of the harm caused including:

⁴⁰ SEPA (2016) *The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) A Practical Guide*, http://www.sepa.org.uk/media/34761/car_a_practical_guide.pdf

harm to the health of human beings and other organisms, [...] harm to the quality of the water environment taken as a whole, and [...] other impairment of, or interference with, the quality of aquatic ecosystems or terrestrial ecosystems directly depending on aquatic ecosystems.

The rules set out in the CAR make no mention of waste that would apply to pre-production plastics, so the material would need to be established as a pollutant for it to be controlled under the regulations. Accordingly, from our review it appears that on the basis that spilt pre-production plastics are considered to be a waste material (which we believe is a correct interpretation), it is an offence for these to enter controlled waters under the Water Resources Act (England and Wales), but not necessarily under the Controlled Activity Regulations in Scotland.

There is also a case for creating new legislation to tackle emissions of pre-production plastics directly. The State of California has specific regulations for pre-production plastics, and these regulations are used as a case study in Section 4.7 to explore how this approach could be used.

4.7 Opportunity for Intervention Using New Legislation: Case Study of Specific Regulations for Pre-Production Plastics in California

The discharge of pellets from drainage outflows and other land-based point-sources into coastal or inland waters is subject to regulation in the United States under the Clean Water Act. In 1990 the United States Environmental Protection Agency published final revisions to the regulations for storm-water discharges (storm-water is the American term for surface water drains and sewers). The revisions ensure that plastic pellets can be regulated under permit guidelines for storm-water discharges by requiring selected industries to obtain permits for all industrial storm sewers that discharge into public waterways and by specifically naming pellets as a significant material to be controlled in this context.⁴¹ In fact, any industrial site with industrial activities exposed to rain water is required to obtain a storm-water permit.⁴²

The State of California took this regulation further with Assembly Bill 258 which became effective in 2008. The bill requires:⁴³

⁴¹ United States Environmental Protection Agency (1992), *Plastic Pellets in the Aquatic Environment: Sources and Recommendations*, December 1992,

<http://www.globalgarbage.org/13%20EPA%20Plastic%20Pellets.pdf>

⁴² Personal communication with Rachel Doughty, Attorney, Greenfire Law, Berkeley, California. Rachel Doughty represented clients prosecuting plastics firms in California for emissions of pre-production plastics.

⁴³ *AB 258 Assembly Bill - CHAPTERED*, accessed 7 December 2016, http://www.leginfo.ca.gov/pub/07-08/bill/asm/ab_0251-0300/ab_258_bill_20071014_chaptered.html

*the state board and the regional boards, by January 1, 2009, to implement a **program for the control of discharges of preproduction plastics** from point and nonpoint sources, including waste discharge, monitoring, and reporting requirements that, at a minimum, target plastic manufacturing, handling, and transportation facilities, and the **implementation of specified minimum best management practices** for the control of discharges of preproduction plastic.*

The minimum best management practices described in the bill are similar to those found in the OCS Manual. These are as follows:

- 1) Appropriate containment systems shall be installed at all onsite storm drain discharge locations that are down-gradient of areas where preproduction plastic is present or transferred.⁴⁴
- 2) At all points of preproduction plastic transfer, measures shall be taken to prevent discharge, including, but not limited to, sealed containers durable enough so as not to rupture under typical loading and unloading activities.
- 3) At all points of preproduction plastic storage, preproduction plastic shall be stored in sealed containers that are durable enough so as not to rupture under typical loading and unloading activities.
- 4) At all points of storage and transfer of preproduction plastic, capture devices shall be in place under all transfer valves and devices used in loading, unloading, or other transfer of preproduction plastic.
- 5) A facility shall make available to its employees a vacuum or vacuum type system, for quick cleanup of fugitive preproduction plastic.

Although the necessary legal framework existed before the bill was passed, the bill was instrumental in subsequent actions to tackle pre-production plastic emissions as it drew attention to the issue and mandated that the water board allocate the necessary resources for monitoring and enforcement.⁴⁵

The bill authorises the state board or a regional board to issue a cleanup or abatement order for enforcement of violations. Citizens can also make prosecutions under US environmental law and an NGO, in collaboration with an environmental law firm, has served notice of permit violations in California under the Clean Water Act to more than 100 of the 3,000 plastic converters present in the state.⁴⁶ Settlement conditions reported include the facility operator submitting to regular inspections and fines of up to \$18,000 which are generally paid to local NGOs (not involved in the legal case) for protection of the watershed, although the reputational damage and inconvenience of legal proceedings may well be the biggest impact upon the facility operators. It is

⁴⁴ Further specific requirements are also set relating to this point which have not been reproduced here but can be found in the Assembly Bill.

⁴⁵ Personal communication with Dylan Seidner for the report Eunomia (2016), Study to Quantify Pellet Emissions in the UK.

⁴⁶ Westervelt, A. (2015) It's taken seven years, but California is finally cleaning up microbead pollution, *The Guardian*

expected that other NGOs will soon take a similar role in regulating plastics manufacturers under US law.

The California legislation presents one model for regulating emissions of pre-production plastics in the UK. If all facilities that handle pre-production plastics were required to obtain a surface water discharge consent from the environmental regulator, and specific limits were placed upon discharges of pre-production plastics in those permits, this would create a strong framework against which discharges could be monitored and offences exceeding the discharge limit could be enforced. This could be further strengthened by defining minimum best-practice measures that operators are required by law to adopt.

It is much easier to assess compliance with best-practice measures than to measure emissions of the plastics material itself, and widespread adoption of best-practice could have a significant impact, although care must be taken to write it in a way that allows flexibility in implementation (i.e. whereby specific companies are free to select the measures that are best practice for their circumstances). If such an approach were adopted it would be prudent to establish the priority of such activities, as was the case in California with the specific allocation of resources for monitoring and enforcement activities.

Environmental permits are one of the key tools through which emissions of pre-production plastics would be regulated under new or existing legislation. In Section 4.8 we consider the implications of this for the environmental regulator and potential issues that would have to be addressed.

4.8 Potential for using Permits to Regulate the Escape of Pre-Production Plastics

The number of sites that are currently controlled by environmental permitting has implications for the cost-effectiveness and feasibility of any regulatory approach.

- Updating *existing* environmental permits, for example the facilities of the 380 polymer supplier companies identified in the ONS data, would require collaboration between the environmental agency and the site operators.
- However, as discussed above, many sites may not currently hold an environmental permit and creating *new* permits for these facilities, which may include many facilities of the 5,790 plastics converters in the UK, would be a more time consuming task.

Similarly, the activities associated with regulating facilities against new permit conditions (such as contact with the operator, monitoring, inspections, enforcement, etc.) could presumably be incorporated without disproportionate additional cost for facilities that already hold an environmental permit. However, the additional cost would be much greater for facilities that currently do not have an environmental permit.

The environmental regulators use risk-based charging schemes whereby the risk posed by the activities undertaken at an installation and the past-performance of the installation determine the level of contact required by the environmental regulator.

Installations deemed to be higher risk require more contact and therefore pay higher charges. This is a cost-effective means of managing industrial facilities and provides an incentive for operators to reduce their risk-score in order to minimise regulatory contact and the associated charges.

The cost of incorporating conditions to control the escape of pre-production plastics in environmental permits would therefore ultimately be borne by the facility owners but would largely be resourced by the staff of the environmental regulators. After an initial assessment of facilities, the costs would decrease for facilities that are shown to be low risk, while facilities that are poor performers would require higher levels of regulatory contact (and pay higher charges) until their performance improves.

Regulation through environmental permitting would appear to have many advantages. It would in theory ensure complete coverage of polymer suppliers and plastics converters, whose facilities would be held to account against specific permit conditions by an independent body. However, industry is unlikely to support additional legislation, especially the imposition of environmental permits where currently none are required. The additional workload for the environmental regulator may also be considerable.

Even though costs would ultimately be recovered from facility owners, the environmental regulator would have to balance new activities relating to the control of pre-production plastics with existing duties. It would therefore be important to demonstrate, in the context of these regulations, that harm is being caused to the environment (and potentially to human health) by the emission of pre-production plastics so that priorities can be managed appropriately. As previously noted in Section 4.2, for marine plastics, it seems that a strong case can be made for the application of the precautionary principle, and for all reasonable prevention measures to be put in place. There would be merit in testing this principle in respect of specific legislation designed to protect the environment and human health.

4.9 Summary of Key Opportunities in Regulation

As discussed above, there is a considerable regulatory framework in place to address pollution that is deemed to be harmful to human health. A recent DEFRA review to inform the implementation of the MSFD found insufficient understanding of current levels, properties and impacts of marine litter and microplastics for either marine litter and microplastics to be included in the UK Marine Strategy.⁴⁷ Research into microplastics and their impacts is a relatively new field and our understanding is improving rapidly. However, as previously noted, the more we learn, the worse the situation seems. Accordingly, it would seem sensible for NGOs to push Government to

⁴⁷ Defra (2014), *Marine Strategy Part Two: UK Marine Monitoring Programmes*, July 2014. Accessible at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/341146/msfd-part-2-final.pdf

apply the precautionary principle in respect of marine plastic pollution, and for all reasonable measures to be implemented.

There is an opportunity to provide evidence on the current levels of microplastics in support of their inclusion in such measures. Significant monitoring programmes for marine litter are already in place, most notably through the work of Fidra, the Marine Conservation Society and others.⁴⁸ A standardised methodology could be developed, in consultation with DEFRA and the environmental regulators, to design a programme that would provide the monitoring evidence necessary to assess the risk posed by microplastics.

Furthermore, the way in which hazardous substances are identified is likely to adapt as our understanding of environmental impact extends. If pre-production plastics and other microplastics were identified as pollutants or hazardous substances then many of the existing regulations outlined above could be employed for monitoring and control.

Currently, the Waste Duty of Care Code of Practice is the most applicable legislation through which the escape of pre-production plastics could be regulated and enforced. However, only a small proportion of facilities are likely to be inspected and monitored by the environmental regulator under the current permitting regime, which limits the likelihood of detecting such offences.

If an emission of pre-production plastics were detected in the environment and it were possible to trace the emission back to its source, then there may be a case for testing Waste Duty of Care Code of Practice for enforcement means. If the source was in England or Wales then the Environmental Permitting Regulations could be also tested in the context of a discharge of waste matter into controlled waters.

Although it would be beneficial to make use of existing legislation and incorporate monitoring and control of pre-production plastics into current environmental programmes, ultimately it may be necessary to create specific regulations to address the issue and allocate the necessary resources for a regulatory approach to be really effective. These regulations could be adopted into existing legislation and, following the approach taken in California, could require facilities that handle pre-production plastics to obtain environmental permits for surface water drainage and adopt best practice approaches to management.

If emission limits on microplastics were set for effluent from waste water treatment facilities this could then allow the water industry to impose similar conditions in trade effluent consents. However, this would be problematic. Ideally there would be no emissions, and as our understanding of the impacts is as yet incomplete, the evidence upon which to identify an 'optimal' level of emissions, or indeed a limit on emissions is lacking. Furthermore, as there are many potential sources for microplastics entering waste water treatment facilities, such as from vehicle tyre dust, if an emissions limit

⁴⁸ See <http://www.nurdlehunt.org.uk/> and <http://www.mcsuk.org/beachwatch/greatbritishbeachclean>

were to be set this would have to be considered in the context of these wider sources of microplastics.

These potential options for regulating emissions of pre-production plastics could be complemented by, and potentially preceded by, an industry-led voluntary approach, as explored in Section 5.0 below.

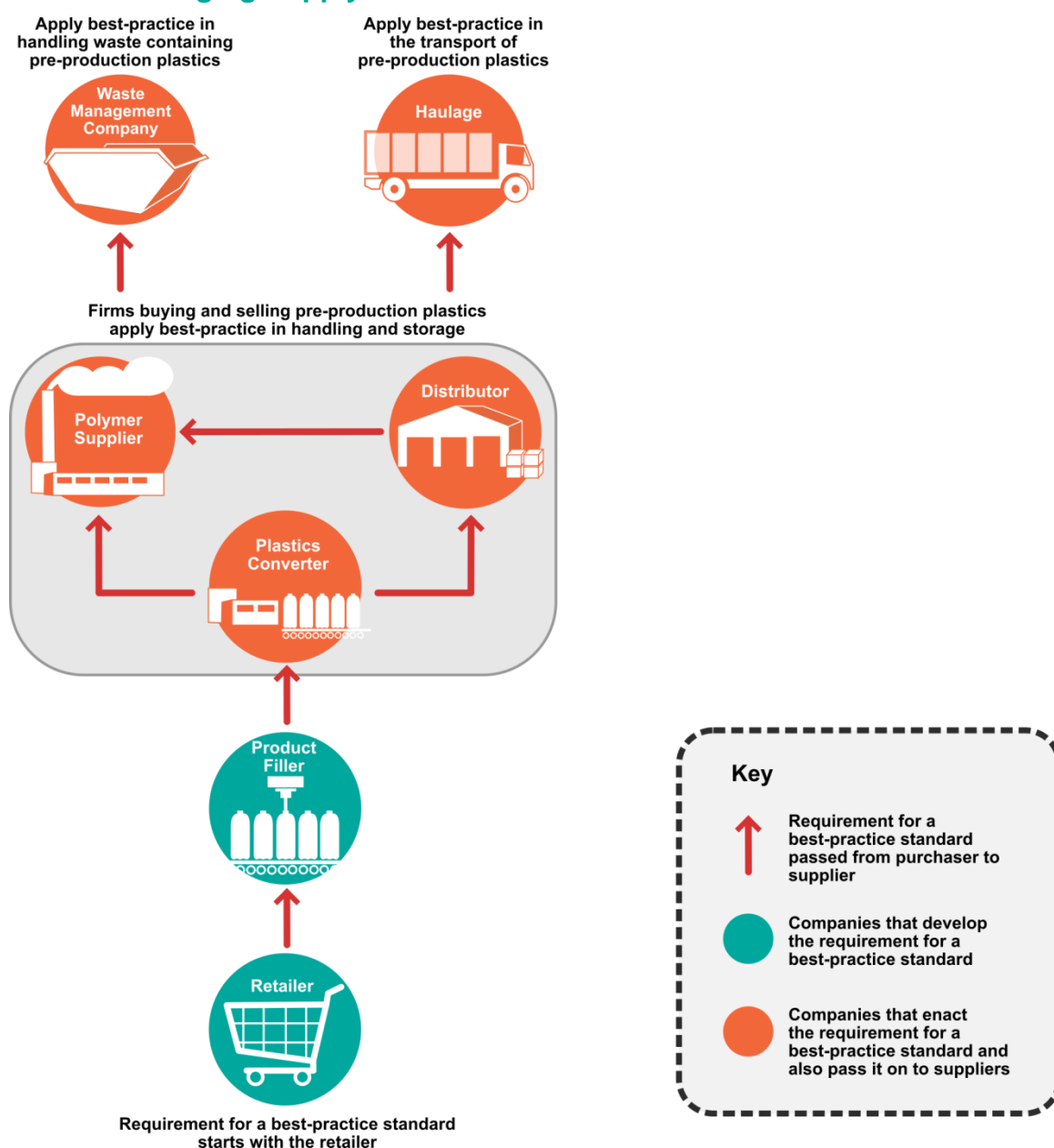
5.0 Industry-Led Enhanced Voluntary Approach

Current efforts to address emissions of pre-production plastics in the UK are led by industry bodies and NGOs through awareness raising activities and direct engagement with companies in the plastics industry. Future industry-led voluntary approaches should look to build upon and compliment current efforts, and ideally reach broader sectors of the plastics industry and improve the transparency of results in a cost-effective and fair manner.

The current voluntary efforts should of course continue but there is a danger that certain parts of the industry will not be reached, such as the many small operators that are not members of industry bodies. Concerns around the impact achieved and the transparency of results could be addressed by developing a programme of independent auditing of OCS. However, this may be considered overly burdensome for the small number of current OCS-signees and the industry body to organise and the additional cost could act as a deterrent to new companies joining the scheme. Other approaches are required that engage a much broader section of the industry and offer a greater incentive for participation

One such approach might be to leverage the purchasing power of large retailers, and other end users, to require that best-practice measures, such as those found in OCS, are adopted by their suppliers. For example, large supermarket chains could require that their food packaging is manufactured in facilities that use best-practice measures. However, the greatest impact would be seen if the requirement did not stop with the plastics converters. Retailers could in fact require that all companies that handle pre-production plastics in the supply chain for their products adopt the best-practice measures, as illustrated for the plastic packaging supply chain in Figure 8. This approach could include plastics converters, polymer suppliers, distributors, waste management companies and haulage firms, all of which would adopt the best-practice measures suited to their particular operations.

Figure 8: Passing the Requirement for a Best-Practice Standard along the Plastic Packaging Supply Chain



A mechanism would be needed to demonstrate compliance with the best-practice measures and that certain standards have been met. For retail packaging this could be achieved by developing a voluntary module for the BRC Global Standard for Packaging and Packaging Materials, which is widely used within the UK. This is based on a best-practice approach, and uses independent auditors with the option of unannounced audits to enable suppliers to achieve a higher rating. Quality standards are also a means by which retailers can be satisfied that legal requirements are met throughout their supply chain, and so the legislative context explored in Section 4.0 could provide additional motivation.

The voluntary module could be based on best-practice measures identified in OCS, after consultation to verify their effectiveness with adaptations as necessary. The module would be explicit in defining the requirements to be met but could also make reference to OCS and be adapted in line with new developments.

The reach and impact of such an approach could be significant. It would extend to companies outside the UK that are part of the supply chain for UK retailers, and it is expected that standards bodies outside of the UK would seek to develop equivalent modules for their standards to facilitate international trade.⁴⁹ The Packaging Standard itself is used in over 80 countries with 3500 sites certified.⁵⁰ The initial impact may also extend beyond plastic packaging as the companies affected (for example the plastics converters) will also be involved in the supply chains for other end uses.

Packaging is a good sector in which to launch a supply chain approach as some of the large supermarkets and department stores, with their high public profile, have proven to be instrumental in addressing other marine debris and environmental issues. Most recent examples include plastic cotton bud sticks and plastic microbeads in personal care products. These companies also have considerable purchasing power in the market and so the supply chain is likely to respond favourably.

Awareness of the issue can be raised in collaboration with retailers, NGOs and the plastics industry once the standards have been updated and the supply chain has had the opportunity to adapt. This will create pressure for other product markets to take similar actions in their supply chains. A template for the voluntary module could be created based on the experience gained in the packaging standards to facilitate easy incorporation into quality standards used in supply chains of other products, such as ISO 9001 and ISO 14001.

This approach may be particularly attractive to markets and brands that have received negative publicity around marine debris issues and have historically resisted certain abatement measures on the grounds that they are disproportionately onerous to implement or would impact upon sales. The best-practice techniques in OCS are designed to be low cost and easy to implement and the additional work to demonstrate this for the quality standards should not be excessive. It could therefore represent a 'quick-win' and gain support from key players in the industry.

The majority of the costs would be borne by industry in adopting the best-practice measures and demonstrating these for quality standard audits, which, as discussed above, should not be excessive. It would be a cost-effective approach in that the system of quality standards and auditing is already in place. Companies that do not already hold a quality standard would bear the greatest additional cost but if only the component

⁴⁹ Personal communication with Iain Ferguson, Environment Manager, Commercial Team – Food Policy, Co-operative Group.

⁵⁰ Personal communication with Joanna Griffiths, Packaging Technical Manager, BRC Global Standards

relating to pre-production plastics is required then presumably this could be accommodated at a reduced rate.

The reach of this approach could extend beyond UK borders, given the international nature of the supply chains, thus delivering greater environmental benefits than if the focus were solely on domestic production. . It should also mean that the approach is fair and is seen to be fair within the UK as foreign companies would be required to follow the same procedures as their UK competitors.

If the standards bodies were able to report on the number of companies adopting the best-practice requirements and indicate the level of compliance this would go a long way to providing meaningful results for public reporting and further improvement. This is particularly important in gaining recognition and support for the scheme and developing public confidence in the impact achieved.

While we provide retail packaging as the example of where such procurement-led measures could be introduced, there is no reason why these measures could not be adopted across all other types of end-users. As shown in Figure 2, there are many firms supplying plastic items to the building sector. Accordingly, an organisation such as the Construction Products Association may be well placed to assist in the establishment of procurement standards relating to the prevention of the loss of pre-production plastics across the sector.

6.0 Summary and Recommendations

6.1 Summary

Current efforts to reduce emissions of pre-production plastics are led by industry bodies and NGOs. However only a small number of companies have signed up to the industry-led voluntary scheme, called Operation Clean Sweep. The potential to reach every company is complicated by the large number of small operators that are not members of industry bodies and thus potentially less likely to be influenced through these channels.

Furthermore, there are concerns about the lack of independent auditing and reporting in Operation Clean Sweep. This makes it difficult to determine the impact of actions taken to prevent spills and also raises questions as to the confidence that can be placed in the effectiveness of the scheme.

In terms of a regulatory approach, there appears to be the potential to use existing legislation to require companies to prevent loss of pre-production plastics at source. The most promising of these, in our opinion, relates to Waste Duty of Care under the Environmental Protection Act. It may be that a test case would be required to determine whether this could be used to incentivise the implementation of best practice measures to prevent the loss of pre-production plastics.

However, the quickest way to achieve widespread uptake of best practice measures, and thus significantly reduce losses to the environment of pre-production plastics, would

appear to be through procurement-led approaches. It is envisaged that regulatory measures could then be implemented to ensure complete coverage.

6.2 Recommendations

Based on the findings of this study, we make the following key recommendations:

- 1) Government should, as a priority, more fully investigate the potential for implementing regulatory measures to prevent the loss of pre-production plastics, building on the initial research presented in this report. Of key importance in this regard is to determine whether Waste Duty of Care under the Environmental Protection Act can be used as a means to require those who handle pre-production plastics to take all reasonable steps to prevent the escape of pre-production plastics from their control;
- 2) At the same time, government should instruct industry (broadly defined) to develop its own proposals (enhanced voluntary measures (EVMs)) for tackling the issue, with the challenge from government being that industry should demonstrate that they could achieve equal or greater reductions in emissions of pre-production plastics than might be expected under a regulatory approach (if they want to avoid the implementation of, or reduce the coverage of, specific regulatory measures). As part of this:
 - a. Government should present the example of what could be achieved through the inclusion of a specific module alongside the BRC Global Standard for Packaging and Packaging Materials in terms of procurement standards and suggest that other sectors and their associations (e.g. the Construction Products Association, which has a sustainability group that covers, amongst other things, green procurement) devise similar strategies.
 - b. Industry should provide a timescale for the introduction of the enhanced voluntary measures. It should be possible for such EVMs to be implemented relatively quickly given that they won't require legislation.
- 3) Government should then decide where immediate regulatory action is needed in order to 'fill the gaps', and review the effectiveness of the EVMs once they're implemented in order to check whether further regulation is required. It is worth noting that if the majority of industry participants are implementing the EVMs, there should be widely held support for legislation to 'level the playing field' and ensure that those not implementing best practice measures are required to do so. Such regulatory action could comprise:
 - a. Enforcing existing legislation, potentially using one or more test cases to determine the action that regulators must take; and/or
 - b. Creating new legislation specifically to tackle the loss of pre-production plastics.
- 4) Finally, there is a strong argument that Government should more fully apply the precautionary principle when it comes to measures to prevent the 'leakage' of plastics into the environment. While our knowledge on the impacts on the environment and human health, and the costs associated with these impacts, is

far from complete what we do know is that the more we find out, the worse things seem. With no reason to suggest that future research will lead to reduced cause for concern, we feel there is merit in taking strong action now - within the bounds of reasonable costs - to prevent, to the extent possible, further losses of plastics (of all sizes) to the terrestrial and aquatic (freshwater and marine) environments.

APPENDICES

A.1.0 Further Detail on EU Regulation

Three EU Directives influence much of the regulatory action in the UK relating to the marine environment and plastics industry facilities. These are:

- The Marine Strategy Framework Directive;
- The Water Framework Directive; and
- The Industrial Emissions Directive.

In the appendix sections below we briefly explore how emissions of pre-production plastics relate to these Directives and their implementation in the UK.

A.1.1 The Marine Strategy Framework Directive

The EU's Marine Strategy Framework Directive 2008/56/EC (MSFD) requires Member States to achieve Good Environmental Status (GES) in EU marine waters by 2020. This involves the identification and management of human activities that impact the marine environment and continual monitoring of the same. Targets for GES are set against 11 descriptors that are listed in Annex 1 of the legislation, among which emissions of pre-production plastics to the marine environment can potentially contravene the following:

(10) Properties and quantities of marine litter do not cause harm to the coastal and marine environment.

However, the legislation outlines that it is not compulsory for Member States to adopt these descriptors. Accordingly, DEFRA transposed the MSFD into UK legislation via the UK Marine Strategy in three parts, with Part 2 (p75 onwards) outlining the strategy for monitoring descriptor 10 on marine litter.⁵¹ It notes:

...the UK initial assessment for the MSFD published last year [...] was not able to provide an assessment of marine litter and its impacts because there is "a limited understanding of current levels, properties and impacts of marine litter. As such marine litter experts were unable to propose quantitative targets indicating the point at which GES would be achieved. Instead a trend based target for litter on coastlines has been developed which requires an absolute reduction in visible litter items on coastlines within specific categories...

The UK Strategy goes on to highlight that insufficient data and incomplete understanding of the issues related to marine litter represent a significant barrier to the establishment

⁵¹ Defra (2014), *Marine Strategy Part Two: UK Marine Monitoring Programmes*, July 2014. Accessible at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/341146/msfd-part-2-final.pdf

of targets at present, with a view to rectifying this in 2018. Importantly for the prevention of emissions of pre-production plastics, it concludes that:

In the UK's Marine Strategy Part One no target was put forward in relation to the Commission Indicator on micro-particles and therefore no monitoring programme has been developed. The nature of micro-particles in the marine environment and their propensity to cause harm is currently not well understood. Defra is supporting further work on micro-particles to get a better understanding of the issues...

At present, there is no strong 'hook' associated with Defra's approach to meeting the requirements of the MSFD that can be used to tackle the loss of pre-production plastics.

A.1.2 The Water Framework Directive

The EU's MSFD is complementary to the EU Water Framework Directive 2000/60/EC (WFD).⁵² The WFD originally committed Member States to achieving good qualitative and quantitative status of all water bodies by 2015, by requiring measurement of water bodies (both ground and surface waters) and implementation of a Programme of Measures for their improvement. With respect to emissions of pre-production plastics, controlling pollution through the reduction of dangerous chemicals in Europe's waters is a key theme in the legislation. The Water Framework Directive also calls for control measures for a number of other pollutants, such as organophosphorus compounds, metals, and materials in suspension. Member States must address these substances in their river basin management plans, as described in Water note 8:⁵³

The process of developing such plans involves the identification of point and diffuse pollution sources and the design of appropriate control measures, including measures to address pollution from industrial, transport and other accidents.

Within this broad scope, the legislation advocates a system of prioritisation to identify key substances for which measures must be adopted. In this respect, one means would be for pre-production plastics to be determined as meeting the characteristics of a priority pollutant which, as per Article 16 of the WFD:⁵⁴

⁵²HM Government (2012), *Links between the Marine Strategy Framework and Water Framework Directives*, December 2012. Accessible at: <http://webarchive.nationalarchives.gov.uk/20130402151656/http://archive.defra.gov.uk/environment/marine/documents/legislation/msfd-factsheet1-waterdirective.pdf>

⁵³ European Commission – DG Environment Water Information System for Europe (WISE) (2008), *Water Note 8 -- Pollution: Reducing dangerous chemicals in Europe's waters*, December 2008. Accessible at: http://ec.europa.eu/environment/water/participation/pdf/waternotes/water_note8_chemical_pollution.pdf

⁵⁴ Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, Official Journal L 327 , 22/12/2000 P. 0001 –

...shall be prioritised for action on the basis of risk to, or via the aquatic environment, identified by a simplified risk-based assessment procedure based on scientific principles taking particular account of:

- Evidence regarding the intrinsic hazard of the substance concerned, and in particular its aquatic ecotoxicity and human toxicity via aquatic exposure routes, and*
- Evidence from monitoring of widespread environmental contamination, and*
- Other proven factors which may indicate the possibility of widespread environmental contamination, such as production or use volume of the substance concerned, and use patterns.*

These requirements were transposed into legislation in England and Wales via the Water Environment (Water Framework Directive) Regulations 2003, which is interlinked with the Water Resources Act (1991) in respect of Part III on the Control of Pollution of Water Resources.⁵⁵

Alternatively, they could be addressed as 'Other Pollutants or Group of Pollutants'. These are substances presenting a significant risk to or via the aquatic environment that have not been deemed priority substances via the ordinary legislative procedure.⁵⁶ For these, the Commission "may prepare strategies against pollution of water by any other pollutants or groups, including any pollution which occurs as a result of accidents."⁵⁷ Member States would be expected to pursue these strategies, but unless made binding via a legislative or regulatory procedure nothing would necessarily oblige them to do so.

A.1.3 The Industrial Emissions Directive

The Industrial Emissions Directive 2010/75/EU (IED) regulates industry activities by placing limits on the emissions of pollutants from industrial installations based on the nature of the processes they undertake. Article 10 provides the scope of the Directive, with Annex I outlining the specific categories of activities this refers to. Within this framework, Category 4 on the Chemical Industry encompasses:

0073, October 2000. Accessible at: http://eur-lex.europa.eu/resource.html?uri=cellar:5c835afb-2ec6-4577-bdf8-756d3d694eeb.0004.02/DOC_1&format=PDF

⁵⁵ England and Wales Law (1991), *Water Resources Act 1991*, Accessible at: <http://www.legislation.gov.uk/ukpga/1991/57/part/III>

⁵⁶ Directive 2000/60/EC Establishing a Framework for Community Action in the Field of Water Policy, Article 16(9).

⁵⁷ Directive 2000/60/EC Establishing a Framework for Community Action in the Field of Water Policy, Article 16(9).

4.1 Production of organic chemicals, such as [...] (h) plastic materials (plastic materials (polymers, synthetic fibres and cellulose-based fibres) [...]

In this respect, the IED appears only to apply to polymer suppliers, and there are no specific conditions what would regulate the accidental loss of pre-production plastics.

The IED is transposed into law in England and Wales by the Environmental Permitting (England and Wales) Regulations 2010 (EPR), in Scotland via the Pollution Prevention and Control (Scotland) Regulations 2012 (PPC 2012), and in Northern Ireland via the Pollution Prevention and Control Regulations (Northern Ireland) 2013.

Within the EPR, Part A activities are those listed under Part A within Schedule 1 of the IED.⁵⁸ These are generally larger industrial activities, (including polymer suppliers) potentially involving discharges to land, air and water, and include activities such as energy production, mineral activities, fertiliser production and certain types of waste management. Part A1 activities fall under the remit of the environmental regulator (the Environment Agency [EA], for England), while A2 falls under the remit of local authorities. Operators of Part A activities require a permit in order to be able to undertake their activity.

Part B activities are those listed under Part B within Schedule 1 of the IED. These are generally smaller industrial activities (such as plastic converters) and operators of Part B activities require a permit in order to be able to undertake their activity. Permits issued to Part B operators permit discharges to air only and fall under the remit of local authorities.

Chapter 4 in Part 2 of Schedule 1 in the EPR lists installations involved in the production of plastic materials (as in the IED) as an A1 activity, subject to obtaining a permit for emissions.⁵⁹

In order to regulate Part A1 permitted activities and enforce the EPR, the Environment Agency uses the OPRA assessment (Operational Risk Assessment) to determine the level and frequency of regulatory contact. Under OPRA, permitted operations/ installations have to report their activities and performance on several scales, from which their overall score allows the Environment Agency to target those that pose the greatest threat to the environment (and charge them accordingly). Annex A of the OPRA Scheme for installations provides detail on the information that is used to estimate the OPRA

⁵⁹ England and Wales Law (2010), *The Environmental Permitting (England and Wales) Regulations 2010* No. 675, April 2010. Accessible at: <http://www.legislation.gov.uk/uksi/2010/675/contents/made>

banding of an installation, and outlines that an emission not already listed within the application form, or below the emissions thresholds do not require a permit.⁶⁰

⁶⁰ Environment Agency (2014), *Opra for EPR version 3.9 - Annex A – Opra Scheme for Installations*, April 2014. Accessible at:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/301773/LIT_6817.pdf