

<b>Title:</b> Impact Assessment on the proposal to ban the supply of single-use expanded and extruded polystyrene food and beverage containers in England <b>IA No:</b> <b>RPC Reference No:</b> <b>Lead department or agency:</b> Department for Environment, Food and Rural Affairs (Defra) <b>Other departments or agencies:</b> N/A	<b>Impact Assessment (IA)</b>
	<b>Date:</b> 20/11/2021
	<b>Stage:</b> Consultation
	<b>Source of intervention:</b> Domestic
	<b>Type of measure:</b> Secondary legislation
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<b>Summary: Intervention and Options</b>	<b>RPC Opinion:</b> N/A
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**Cost of Preferred (or more likely) Option** (in 2020 prices, 2023 present value)

Total Net Present Social Value	Business Net Present Value	Net cost to business per year	Business Impact Target Status
-£332.4m	-£371.3m	£43.1m	Qualifying provision

**What is the problem under consideration? Why is government action or intervention necessary?**

Expanded and extruded polystyrene (EPS) food and beverage containers are commonly used and frequently discarded and littered. This causes multiple negative externalities, including harm to marine animals, cost to local authorities and visual pollution.

Polystyrene is not recycled in the UK.<sup>1</sup> In addition, EPS items do not biodegrade or photodegrade and so they accumulate in the environment. EPS items are especially fragile in their physical nature, meaning that once littered these items tend to fragment into smaller pieces and are dispersed into the environment. Finally, the production of plastics (including EPS) is reliant on fossil fuels, meaning production leads to resource depletion and greenhouse gas emissions.

These external costs are not incorporated in the market price of single-use EPS and providers of these items do not have incentives to cover the externality costs. Therefore, intervention is required to shift the EPS market to either reusable or plastic-free alternatives that already exist, are readily recyclable and/or decompose much quicker, and to ensure the change and environmental benefits are sustained into the future.

**What are the policy objectives of the action or intervention and the intended effects?**

The objectives are to help protect our environment for the future generations, improve the quality of the environment and reduce harm to human health and marine life. The policy will also contribute to the Government’s commitment to eliminate avoidable plastic waste over the lifetime of the 25 Year Environment Plan.

The ban will ensure that single-use food and beverage containers such as boxes, cups, pots, trays and cones in England currently made of expanded and extruded polystyrene are made of more environmentally friendly materials which have lower life-cycle impacts on the environment. The ban may also encourage UK businesses to invest in environmentally friendly alternatives to plastic and increase consumer awareness of the environmental harms EPS items can cause when they are not disposed of correctly.

**What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)**

A number of options have been considered, including taxes/charges, subsidies and information campaigns. As a key objective of our work is to reduce the amount of single-use plastic litter in the marine environment we have focussed on two central options: 'do nothing' (option 0), or a ban (option 1, preferred). A ban is preferred as it would have the maximum impact in reducing the social costs of single-use plastic plates and cutlery. The impacts of a ban are proportionate to secure the environmental benefits without major costs. The current trend in the market for single-use plates and cutlery is to move away from plastic and alternate material products are readily available. When considering alternative options such as taxes/charges, subsidies and information we have drawn on our previous work on single-use plastic items such as straws, stirrers and cotton buds. Past experience has shown that these options would likely not be as effective as a ban in reducing the significant social costs of single-use plastic plates and cutlery, particularly on reducing marine litter. However, we welcome views on the effectiveness of these alternative options at consultation.

<sup>1</sup> WRAP (2021) [Eliminating Problem Plastics](#)

<b>Will the policy be reviewed?</b> It will be reviewed. <b>If applicable, set review date:</b> 5 years post implementation				
Is this measure likely to impact on international trade and investment?		Yes		
Are any of these organisations in scope?	<b>Micro Yes</b>	<b>Small Yes</b>	<b>Medium Yes</b>	<b>Large Yes</b>
What is the CO <sub>2</sub> equivalent change in greenhouse gas emissions? (Million tonnes CO <sub>2</sub> equivalent)		<b>0.075</b>	<b>Mt</b>	<b>CO<sub>2</sub>e</b>

*I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.*

Signed by the responsible SELECT SIGNATORY: ..... Date: .....

## Summary: Analysis & Evidence

## Policy Option 1 (Preferred)

Description: A ban on the supply of single use expanded and extruded polystyrene food and beverage containers in England

### FULL ECONOMIC ASSESSMENT

Price Base Year 2020	PV Base Year 2023	Time Period Years 10	Net Benefit (Present Value (PV)) (£m)		
			Low: -523.3	High: -253.3	Best Estimate: -389.9

COSTS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	95.7	26.9	333.0
High	160.7	45.2	558.4
Best Estimate	128.0	36.0	445.2

#### Description and scale of key monetised costs by 'main affected groups'

The wholesale price of paper food and beverage containers such as boxes, cups, pots and trays and cones (i.e. the expected alternative) is greater than the unit costs of EPS equivalents. This means there will be additional costs to businesses of which we expect 60% will be passed on to consumers. However, for the cost to business calculation (i.e. EANDCB) all costs are assumed to be absorbed by businesses with no consumer pass-through. This is based on guidance from the Regulatory Policy Committee.

Paper weighs more than EPS and so there will be additional waste management costs to businesses and Local Authorities.

We have monetised the cost of additional emissions expected from paper boxes, pots, cups and trays and cones sent to landfill. This is because plastic emits less carbon dioxide equivalent (CO<sub>2</sub>e) emissions when placed in landfill relative to paper.

There is also an additional fuel cost to businesses associated with transporting boxes, cups, pots and trays and cones, as the paper alternatives weigh more than EPS. This additional fuel consumption will create CO<sub>2</sub>e emissions.

Monitoring and enforcement costs to the public sector have also been included.

#### Other key non-monetised costs by 'main affected groups'

Some consumers may lose out if they prefer EPS food and beverage containers to alternatives.

BENEFITS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	0.0	4.0	35.1
High	0.0	9.1	79.7
Best Estimate	0.0	6.3	55.3

#### Description and scale of key monetised benefits by 'main affected groups'

Paper food and beverage containers are less carbon intensive to both produce and incinerate than EPS, resulting in environmental savings. As paper decomposes much quicker than EPS, we expect to see a reduction in the presence of litter on beaches, reducing clean up costs for beaches. Clean beaches are highly valued by the public.

#### Other key non-monetised benefits by 'main affected groups'

Single-use EPS items contribute to marine litter which impacts wildlife as materials can entangle or be ingested by marine wildlife, causing injury and loss of life to marine animals. Also, plastics break down slowly and some may persist as microplastics for a substantial period of time. Microplastics ingestion by animals has been shown to reduce food consumption and therefore energy levels in marine life<sup>2</sup> and can be passed down the foodchain. The proposed policy option (together with other policy measures) is likely to have a significant positive impact on the marine environment (beaches and seas).

Finally, marine litter has a disamenity cost to society, affecting pristine seascapes and quality of life which impacts those who use marine environments and also impacts those who value knowing that there is a pleasant environment available to them and to others.

<sup>2</sup> <https://www.exeter.ac.uk/research/feature/microplastics/>

<b>Key assumptions/sensitivities/risks</b>
<p>We assume that 80% of the food and beverage container market in England is currently EPS, as estimated by Defra commissioned research.<sup>3</sup></p> <p>Following voluntary commitments already made by industry, for example the UK Plastics Pact<sup>4</sup>, we assume the majority of retailers will move away from single-use EPS items over time regardless of the ban. Under our baseline scenario of no ban on EPS items, we forecast a 5% reduction per annum in EPS item usage, with low and high sensitivities of 0% and 10% respectively. We will be testing all these assumptions as part of the public consultation.</p> <p>We assume paper will be the replacement material due to the current usage and trends in replacing plastic. Monetised costs may fall significantly if the price of non-plastic alternative food and beverage containers fall, which is possible as their scale of production increases. This material price, which we have estimated very conservatively, makes up 69% of total costs<sup>5</sup> so any reduction in it will have a significant effect on the final NPV. We welcome views from industry on these assumptions in the public consultation.</p>

### **BUSINESS ASSESSMENT (Option 1)**

<b>Direct impact on business (Equivalent Annual) £m:</b>			<b>Score for Business Impact Target (qualifying provisions only) £m:</b>
<b>Costs: 50.6</b>	<b>Benefits: 0.0</b>	<b>Net: 50.6</b>	

3 Resource Futures (2019), A Preliminary Assessment of the Economic Impacts of a Potential Ban on EPS Food and Beverage Containers, Final Report

4 See e.g. <https://wrap.org.uk/taking-action/plastic-packaging/the-uk-plastics-pact>

5 Under our central scenario, material price total PV cost is £306.5 million and total cost PV is £445.2 million.

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## Problem under Consideration

Single-use expanded and extruded polystyrene (EPS) food and beverage containers, such as boxes, cups, pots, trays and cones, are environmentally damaging. Such items are commonly used and often disposed of inappropriately at the end of their life.

Plastic production and disposal (including EPS) depend on finite fossil fuels and therefore lead to resource depletion and greenhouse gas emissions. In addition, polystyrene items do not biodegrade or photodegrade; EPS items in particular are especially fragile in their physical nature and tend to fragment into smaller pieces. This leads to an accumulation of plastic in the environment.

Littering of EPS items negatively impacts on wellbeing and generates clean-up costs to local authorities – UK municipalities are estimated to be spending approximately £15.5m each year to remove all forms of beach litter.<sup>6</sup> Single-use EPS food and beverage containers are often littered in parks and public places; these items can then be transferred to the marine environment through sewage and storm drainage. They are also littered directly into the marine environment by marine users and visitors to coastal areas. The Marine Conservation Society's Great British Beach Clean 2018<sup>7</sup> indicates plastic/polystyrene pieces are the most frequently counted litter item on UK beaches. Overall, plastics are thought to represent 50-80% of shoreline debris<sup>8</sup>. It is estimated that there are over 150 million tonnes of plastic in the world's ocean. Estimates also find that every year one million birds and over 100,000 sea mammals die from entanglement in marine litter in the North Pacific alone; a rate that appears to be increasing<sup>9,10</sup>.

Whilst clean single-use EPS food and beverage containers can technically be recycled, this is not a widespread practice in the UK due to lack of appropriate infrastructure<sup>11</sup>. In addition, as the material is lightweight and dispersed, EPS used in food service packaging is inherently costly to collect and contamination renders items useless to reprocessors. As a result, single-use EPS items are typically discarded to general waste or littered rather than recycled due to the effort required to segregate and clean them.

Meanwhile, plastic-free single-use food and beverage containers are already established in the market. Paper is a widely used alternative material for these items and offers little change in consumer experience whilst reducing environmental impacts.

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6 [Mouat, Lozano, Bateson](#): Economic Impacts of Marine Litter, 2010. Figure based on exchange rate of £1 = EUR 1.1622

7 [The Great British Beach Clean | Marine Conservation Society \(mcsuk.org\)](#)

8 Thompson, R.C., et al., Plastics, the environment and human health: current consensus and future trends. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 2009.

9 Thompson, R.C., et al., Plastics, the environment and human health: current consensus and future trends. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 2009.

10 Mouat, J., R.L. Lozano, and H. Bateson, Economic Impacts of Marine Litter, 2010.

11 See e.g. <https://wrap.org.uk/sites/default/files/2021-07/Eliminating-problem-plastics-v3.pdf>

## Rationale for Intervention

As single-use EPS food and beverage containers are not widely recycled in the UK, most are either incinerated for energy or sent to landfill at the end of their life, releasing carbon dioxide emissions.<sup>12</sup> In addition, some single-use EPS items are littered<sup>13</sup>, which costs public money to clean-up.<sup>14</sup> It also imposes a number of other costs on society including visual pollution and environmental harm. Littered single-use EPS products also pose a risk to wildlife - either in their full form or from breaking down into microplastics - they can easily be ingested by marine life if they enter the water system and/or marine environment, captured as marine debris in fishing equipment, washed up as litter on beaches.<sup>15</sup>

The market price for single-use EPS food and beverage containers does not account for such negative externalities. As such, businesses and end-consumers are not currently incentivised to limit their use, to dispose of single-use EPS items appropriately and/or to switch to items made of less environmentally harmful materials. Intervention is required to ensure businesses and consumers switch to less environmentally harmful alternatives.

Single-use EPS containers have readily available alternative material products – paper items for single-use or reusable options. Paper decomposes quicker and is less carbon intensive to manufacture and incinerate than plastic, causing less environmental damage. A ban in this area will further help to signal to consumers the issues with single use plastics and that more environmentally friendly alternatives, or reusable items are a superior option.

There is strong rationale for government to intervene to ban single-use EPS food and beverage items in order to significantly speed up the decline in the use of EPS. A ban, rather than reliance on voluntary action, would stem the flow of single-use EPS items faster and more widely, ensuring that the environmental benefits are achieved quicker and maintained into the future.

The forecasted trend of a 5% decline in EPS usage<sup>16</sup> in favour of alternative material substitutes is used for the purpose of this analysis to provide a conservative estimate of the impact of a ban in light of current voluntary action. However, it is important to note that the projected trends are forecasts, and there is no guarantee that, in the absence of a ban, usage of single-use EPS items will decrease by as much as predicted or would not rise again in the future. For example, this might happen if current public awareness and media attention on single-use plastics is not sustained.<sup>17</sup>

Government action to ban the supply to the end user of single-use EPS food and beverage containers where alternatives are readily available means that the change needed to reduce England's harmful and unnecessary plastic pollution in our oceans is secured across the market, and that the negative effects these items have on the environment are addressed as soon as possible.

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12 See e.g. <https://ellenmacarthurfoundation.org/the-new-plastics-economy-rethinking-the-future-of-plastics-and-catalysing>

13 See e.g. <https://wrap.org.uk/resources/report/eliminating-problem-plastics>

14 Government Office for Science, *Foresight Future of the Sea*

15 Gall, S. C. & Thompson, R. C. (2015), The impact of debris on marine life. *Marine Pollution Bulletin* 92, 170-179

16 Defra modelling

17 see e.g. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4248563/#R102> making the case for public health information campaigns needing longer and better-funded continuations as well as a range of other measures in order to be effective

## Policy Objective

In the 25 Year Environment Plan,<sup>18</sup> the Government set out its ambition to help protect our environment for future generations, improve the quality of the environment, and reduce harm to human health and marine life. This ambition was followed by the publication of the Resource and Waste Strategy. The strategy shows how we will both prevent and better manage waste by moving to a more circular economy.<sup>19</sup> It also gives a clear direction related to plastics via the following ambitions:

To eliminate avoidable plastic waste by the end of 2042 and a target to reduce significantly and where possible prevent all kinds of marine plastic pollution;

To work towards all plastic packaging placed on the market being recyclable, reusable, or compostable by 2025.

As part of the former ambition, the Government wants to ban the most problematic plastic products where there is a clear case for it and alternatives exist. Bans on the sale of plastic microbeads are already in place. Restrictions on the supply to the end user of single-use plastic drinking straws (with exemptions for use as medical devices and for those with disabilities who rely on them to eat and drink safely and independently) and cotton buds (with exemptions for medical, scientific, and forensic purposes) and a prohibition on the supply of drinks stirrers came into force in October 2020.<sup>20</sup> We are now considering the impact of banning single-use EPS food and beverage containers. The ban on EPS items is intended to ensure that single-use food service items sold in England are made of less environmentally harmful materials which decompose more quickly and have lower overall impact on the environment. The ban may also encourage businesses to invest in alternative options to single-use EPS, such as reusable options or innovative material substitutes. This is because it would create a level playing field as any consumer preference for single-use EPS items would no longer be a viable choice. A ban would also strengthen the domestic plastic-free market by protecting it from low-priced single-use plastic imports.

It is intended that banning the supply of single-use EPS food and beverage containers to the end users will foster an increased degree of consumer confidence that the products they buy will not harm wildlife and the environment. It will also increase consumer awareness of the environmental harms these items can cause when they are not correctly disposed of. This is supported by our consultation in early 2019 on restricting the sale of plastic straws where 83% of respondents supported the ban, with most respondents focused on the environmental harm caused by plastics.<sup>21</sup>

A fear associated with banning a product is that there will not be alternative products that consumers can use. This is not the case with single-use EPS food and beverage containers such as boxes, cups, pots and trays and cones, as paper alternatives and reusable items are already available. Further, several voluntary agreements are also concentrating on phasing out harmful plastic. Members of the UK Plastics Pact, which comprises organisations such as the Food Packaging Association, have pledged to eliminate problematic or unnecessary single-use plastic packaging through redesign, innovation or alternative delivery models (such as reuse) by 2025.<sup>22</sup> Waste and Resources Action

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<sup>18</sup> [A Green Future: Our 25 Year Plan to Improve the Environment](#)

<sup>19</sup> [Our Waste, Our Resources: A Strategy for England](#)

<sup>20</sup> [Straws, cotton buds and drink stirrers ban: rules for businesses in England](#)

<sup>21</sup> [Single use plastic: banning the distribution and/or sale of plastic straws, stirrers and plastic-stemmed cotton buds in England](#)

<sup>22</sup> <https://wrap.org.uk/taking-action/plastic-packaging/the-uk-plastics-pact>



Plan (WRAP) have identified polystyrene packaging (both expanded and non-expanded varieties) as one of eight plastic items needed to be eliminated from circulation by 2020.<sup>23</sup>

A ban on the supply to the end user of single-use EPS food and beverage containers is part of the wider policy objective to eliminate avoidable plastic waste by the end of 2042. This measure should be viewed as part of a wider package of reforms, which use different policy instruments, as detailed in the Resources and Waste Strategy<sup>24</sup>. A ban was chosen as the most appropriate instrument here as single-use EPS food and beverage containers are avoidable plastic, which cause environmental harm and are easily replaceable.

Together with other measures, the ban will help reduce the flow of these items to the ocean from English sources. It should also drive behaviour change, by stimulating businesses and consumers to reconsider their use of single-use plastic items in favour of more sustainable material choices or reusable alternatives.<sup>25</sup>

Although out of scope of this analysis, the policy will also complement our wider proposals to tackle plastic pollution, and especially those associated with plastic packaging waste. In addition to plastic straws, stirrers, and cotton buds which we have already banned, we are consulting on proposals to ban plastic balloon sticks as well as single-use plastic plates and cutlery.

Plastic packaging waste accounts for nearly half of all plastic waste generated in the UK<sup>26</sup>. Our proposals to reform the packaging waste regulations and introduce a new plastic packaging tax<sup>27</sup> will ensure that plastic packaging is designed to be recyclable and make more use of recycled content. Introducing greater consistency in household and business recycling collections across England will help citizens recycle more and increase the amount of plastic that is collected and made available for recycling. Additionally, introducing a Deposit Return Scheme will substantially increase recycling rates for plastic drinks containers, providing a high-quality stream of recyclable material which can be fed back into the production of new plastic products.

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23 WRAP, [Eliminating Problem Plastics](#)

24 [Our Waste, Our Resources: A Strategy for England](#)

25 see e.g. Adeyanju, G.C., Augustine, T.M., Volkmann, S. *et al.* Effectiveness of intervention on behaviour change against use of non-biodegradable plastic bags: a systematic review. *Discov Sustain* 2, 13 (2021). <https://doi.org/10.1007/s43621-021-00015-0> for similar rationale in regard to plastic bags

26 WRA, [Plastics Market Situation report 2019](#)

27 HMRC, [Plastic packaging tax](#)

## Options under consideration

The impact assessment considers two options: the ‘do-nothing’ option and the option **to ban single-use expanded and extruded polystyrene food and beverage containers in England**, legislated in October 2022, and coming into force in April 2023. The latter is our preferred option because it is considered to be the most effective in reducing the social and environmental costs associated with these single-use items.

We have also considered several alternative policy options, however we do not, at this time, believe they would eliminate these single-use plastic items at the same speed and scale as the proposed ban. Other interventions would not create a level playing field and therefore would not strengthen the market to innovate – something which was highlighted in stakeholder discussions that were undertaken by Resource Futures<sup>28</sup>. We are happy to hear further views on this at consultation and will reflect on these for the final impact assessment. These alternative options are listed in the section below.

### Option 0: Do nothing

The **do nothing** option would allow single-use EPS food and beverage containers to continue being used with no restrictions on supply. Some businesses are voluntarily moving away from single-use EPS; this is factored into the do nothing scenario.

The problem associated with this option is that, although there is currently a concerted voluntary reduction in single-use EPS container use, there will still be many such items that continue to be used and disposed of over the coming years. Furthermore, there is no guarantee that the current voluntary action will be sustained into the future, which may be the case if current media and public attention on the issue does not persist. This means the environmental costs associated with EPS, such as risks to wildlife and the marine environment, may continue into the future even if voluntary action is successful at supplying plastic-free alternatives at scale without the support of government intervention.

### Option 1: Implement a regulatory ban on the supply of single use expanded and extruded polystyrene food and beverage containers to the end user in England, active from April 2023 (preferred)

This is the preferred option. As described in the rationale for intervention section, single-use EPS items impose environmental and social costs; a ban on the supply to the end user will reduce these significantly after April 2023. This intervention will secure the change and associated environmental benefits quickly and ensure that these are sustained into the future.

Businesses will be encouraged to source food and beverage container items from non-plastic materials, or to stop stocking such single-use items altogether. This is expected to incur some costs, but some of these will be mitigated if the cost of alternative material products falls. This might occur due to current trends in the market to move away from single-use plastic items and the increasing availability of non-plastic alternatives. There will also be some familiarisation costs to business in preparation for the change in legislation.

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<sup>28</sup> Defra has commissioned Resource Futures to produce a research report on this, including information gathering via stakeholder interviews.

The ban will foster an increased degree of consumer confidence that the products they buy will not harm wildlife and the environment. It will also increase consumer awareness of the environmental harms single-use products can cause when they are not correctly disposed of. The intervention is expected to increase wellbeing from reduced presence of litter and to reduce the associated clean-up costs, as monetised later on in this document.

There is evidence that bans have effectively reduced the littering of targeted single-use plastics in the environment. For example, following the implementation of the San Francisco ban on polystyrene cups in 2007, their littering dropped by 34%. Similarly, following their 2011 ban in San Jose, littering of plastic bags was reduced by 59% to 89%, according to locations.<sup>29</sup>

No exemptions are currently proposed under this ban as, unlike straws for example, we are not aware that anyone has an absolute requirement for single-use EPS food and beverage containers over their non-plastic alternatives (e.g. for medical use). We are inviting stakeholder views on this in the consultation published alongside this document. Considerations will also be assessed in our Equalities Assessment post-consultation and in analysis on the impact on small and micro businesses.

## Alternative options

In the 25 Year Environment Plan, and reiterated in the Resources and Waste Strategy, we commit to eliminating all avoidable plastic waste throughout the lifetime of the plan. The impact that plastic pollution is having on our environment is well documented, and urgent action is required to stem the flow of these materials into the natural world. The Strategy outlines how we want to address this issue, taking action at each stage of the product lifecycle to reduce the amount of plastic we use, and reuse and recycle more of what we do use. Alongside measures such as Extended Producer Responsibility for packaging and a Deposit Return Scheme for drinks containers, we believe that there are unnecessary and harmful uses of plastic which can be dealt with most effectively by introducing a ban as there are already viable non-plastic alternatives.

Tackling the issue of marine plastic pollution is not something which we can do in isolation. Other countries are taking similar action to reduce the use of plastic. For example, the EU have introduced a number of product bans which were implemented and came into force in July 2021, these include plastic plates and cutlery and EPS.<sup>30</sup> Having left the EU, the UK is not legally obliged to meet the SUP directive, however we are focused on matching the ambition of the Directive in ways that work best for us. Scotland are also planning to restrict the sale of single-use EPS food and beverage containers from 2022 among other single-use plastic items<sup>31</sup>, and Wales have consulted on implementing a ban on the products<sup>32</sup>.

The following are considered as alternative options but we believe they would not reduce the impacts to the environment in the same speed and scale as a ban would:

- **Information and education** could be used to encourage firms and consumers to move away from single-use EPS food and beverage containers. However, there is evidence that consumers are already acutely aware of the harms of single-use plastics. There have been multiple campaigns in recent times including the BBC's Blue Planet II series and the Daily Mail's "Break the Habit, Turn the Tide on Plastic and the Stir-Crazy" Campaign. The additional

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29 OECD (2021), [Preventing single-use plastic waste: implications of different policy approaches](#)

30 European Commission, [Single-use plastics](#)

31 Zero Waste Scotland (2021) [Single-use plastics: new laws come into force June 2022](#)

32 [Reducing single use plastic in Wales](#)

impact of further information being provided on top of these campaigns is likely to be minimal and so may not be cost effective. Additionally, studies examining the effects of environmental information provision provide limited support for the success of this option. Informational interventions may succeed in improving people's knowledge about the negative environmental consequences of one's actions, but this knowledge will not gain motivational force if people do not consider protecting the environment an important personal value.<sup>33</sup>

- **Request only option** – single-use EPS food and beverage containers could be made available by request only in all settings e.g. available only if a customer specifically asks for one, but the impacts in reducing usage would be smaller, and less certain, than under a ban. Additionally, it would be difficult to monitor if businesses are complying.
- **Subsidies** towards the development of non-plastic food and beverage containers are not considered necessary. The alternatives already exist and several major chains have already committed to using them.
- **A taxation or charge policy.** Although this would likely be effective in reducing consumption, it would not be as effective as a ban where suitable alternatives are available. Another risk with a charge instead of a ban is that effectiveness reduces over time without further intervention. For example, in Ireland, plastic bag usage initially fell with the introduction of the first levy in 2002, but rose again five years post levy, requiring the charge to be increased<sup>34</sup>. A ban avoids this risk and ensures that the desired impact is sustained. Furthermore, a tax in this instance would be economically inefficient. Taxing plastic goods is a proxy for taxing plastic waste, which entails lower efficiency relative to the latter.<sup>35</sup>

We welcome evidence on the merit of these alternative policy options at the public consultation to inform our position in the final stage impact assessment.

## Summary of Impacts and NPVs – Preferred Option

Table 1 below gives a summary of the monetised costs and benefits and total Net Present Value (NPV) estimates for the preferred option to ban single-use EPS food and beverage containers compared to what we expect would happen if there were no government intervention (i.e. under the 'do nothing' option). This is estimated over a ten-year appraisal period.

We have developed 3 different scenarios (low, central, high) to enable sensitivity analysis. This is to reflect data uncertainties and to help investigate the significance of key assumptions, used in the analysis.

The central estimate of NPV is -£389.9m. The largest positive contribution comes from beach wellbeing benefit. This benefit is calculated using conservative willingness to pay estimates from Eunomia.<sup>36</sup> The largest impacts that have been monetised are the costs incurred from alternative material food and beverage containers being more expensive than their respective EPS product, which we have modelled as being shared between consumers and businesses for the purposes of

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33 Bolderdijk JW, Gorsira M, Keizer K, Steg L (2013) Values Determine the (In)Effectiveness of Informational Interventions in Promoting Pro-Environmental Behavior.

34 Institute for European Environmental Policy, [Plastic Bag Levy in Ireland](#)

35 OECD (2021), [Preventing single-use plastic waste: implications of different policy approaches](#)

36 Eunomia, Exploring the Indirect Costs of Litter in England, 2014

NPV calculations. However, for the annual net direct cost to business metric, we have attributed this cost fully to businesses, as per Regulatory Policy Committee guidance.

**Table 1: 10 Year NPV estimates resulting from a ban on single-use expanded and extruded polystyrene food and beverage boxes, pots, cups and trays and cones (£million)**

		10 Year NPV estimates		
		Low	Central	High
<b>Benefits</b>	Production Emission Savings	£11.1	£14.8	£18.5
	Disposal incineration emission benefit	£7.8	£10.4	£13.0
	Reduced coastal clean-up costs	£1.0	£1.4	£1.7
	Beach well-being benefit	£15.2	£28.7	£46.4
<b>Costs</b>	Landfill disposal emission cost	-£4.7	-£3.7	-£2.8
	One-off Capital Investment	-£158.7	-£127.0	-£95.2
	Waste Management Costs to Businesses	-£0.8	-£0.6	-£0.4
	Waste Management Costs to LAs	-£7.3	-£5.2	-£3.4
	Paper costs to businesses (retail)	£0.0	-£122.6	-£229.9
	Paper costs passed to consumers	-£383.1	-£183.9	£0.0
	Familiarisation Costs	-£2.0	-£1.0	-£0.5
	Enforcement costs	-£0.6	-£0.6	-£0.5
	Fuel costs	-£0.8	-£0.5	-£0.3
	Fuel Emissions Costs	-£0.3	-£0.2	-£0.1
<b>Total</b>		<b>-£523.3</b>	<b>-£389.9</b>	<b>-£253.3</b>

Note: Our high sensitivity is high benefit and low cost. Comparatively, our low sensitivity is low benefit and high cost. For paper costs to businesses, this is the inverse as we have assumed that businesses will pay 0% of costs in the low scenario, 40% in the central, and 100% in the high scenario. Likewise, we assume consumers pay 100% of costs in the low scenario, 60% in the central, and 0% in the high scenario. Totals may not add up exactly, due to rounding.

Further detail on Table 1 can be found in the costs and benefits sections below. All figures are in 2020 prices.

Although the final NPV is negative, the ban remains the preferred option due to the non-monetised factors excluded from the NPV estimates. A particularly strong benefit which has not been monetised is the reduction in harm to marine wildlife and the associated societal wellbeing benefits. Although it has not been possible to monetise these benefits, they are discussed in detail as non-monetised benefits below. Another consideration is that the monetised costs may fall significantly if the price of non-plastic alternative food and beverage containers fall, which is possible as scale of production increases. This material price, which we have estimated very conservatively, makes up 69% of total costs so any reduction in it will have a significant effect on the final NPV. We welcome industry responses on this in the public consultation.

# Key Assumptions and Methodology

## Low/Central/High Scenarios

We have modelled three different scenarios to account for the uncertainties related to the cost assumptions, the number of single-use EPS boxes, cups, pots, and trays and cones consumed in England as well as the market share of alternatively made items.

The low NPV scenario (worst case) uses the low estimate for the total number of single-use EPS food and beverage containers. It then applies the high costs and low benefits estimates to them. The high NPV scenario (best case) uses the largest estimate for the number of items used and applies the high benefits and low costs estimates. The central scenario represents the average between the low and the high scenarios.

Concerning the business cost pass-through estimates to consumers, we have assumed 100% of the costs are passed through to consumers under the low scenario, 60% pass-through in the central scenario, and 0% pass-through in the high cost scenario. We are testing these assumptions at consultation.

The following sensitivities have also been incorporated into the NPV scenarios and are further explained in the sections on monetised costs and benefits:

- how long each item would take to decompose;
- the proportion of items that end up on beaches as litter;
- and differing values in the literature placed on having cleaner beaches.

## Single-use food and beverage containers

Resource Futures estimate that single-use EPS food and beverage containers account for 80% of the market, with the remaining 20% of items being made from paper.<sup>37</sup> On average, a person in England uses 3 single-use EPS boxes, 8 single-use EPS cups, 6 single-use EPS pots and 3 single-use EPS trays and cones annually.<sup>38</sup> We welcome evidence on these assumptions at the public consultation.

Applying these estimates to the mid-2020 projection of the population (56,550,138)<sup>39</sup> generates the central estimate of single-use EPS items consumed. Table 2 illustrates the low and high estimates, assuming consumption to be 75% and 125% of the central estimate.

**Table 2: Consumption estimates of single-use products in England**

Product	Per capita units per annum, England*	Consumption per annum, England**	Total consumption (EPS and paper) per annum, England**
Single use EPS boxes	3	175 million	219 million
Single use EPS cups	8	475 million	594 million

37 A baseline market share for the year 2020.

38 Resource Futures, Economic assessment of a potential ban on expanded polystyrene, 2019

39 ONS, [Population estimates for the UK, England and Wales, Scotland and Northern Ireland: mid-2020](#)

Single use EPS pots	5	317 million	396 million
Single use EPS trays and cones	3	187 million	233 million

\*Resource Futures estimates

\*\* Defra estimates, using Resource Futures per capita estimates and England population estimates

## Counterfactual

We assess the costs and benefits of the preferred option against the absence of the ban (i.e. in the 'do nothing' scenario). Estimates in the central NPV scenario are based on the total consumption of single-use containers in England (219 million single-use boxes, 594 million single-use cups, 396 million single-use pots, and 233 million single-use trays and cones) and account for the current and projected variation in market share of EPS and alternative materials (paper).

It would be unrealistic to assume that the consumption of single-use EPS food and beverage containers remains at the same level under the 'do nothing' scenario. This is because the market for single-use boxes, cups, pots, and trays and cones has already begun moving away from EPS, with paper alternatives accounting for 20% of the market<sup>40</sup>. Assuming that consumption of single-use EPS items remains high would likely lead to an overstatement of the costs and benefits the ban would bring. The central scenario models a 5% annual fall in market share of EPS items in the absence of a ban.

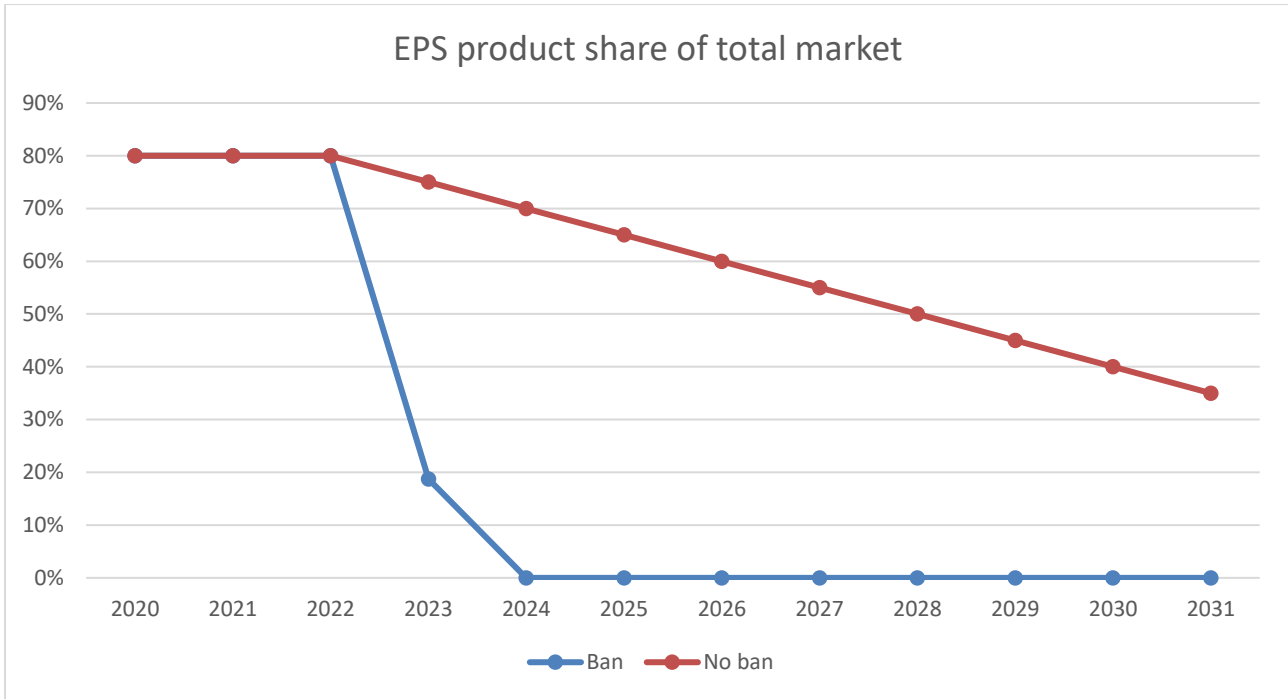
We have selected paper as the alternative material as this is the most prevalent alternative material in the current market. However, with technological development, it is possible that different materials will be used. We would welcome evidence in our consultation on the proportion of boxes, cups, pots and trays and cones sold in England that are made from EPS, including any trends in the market for alternative materials.

We have modelled three scenarios for take up of alternatively made single-use food and beverage containers in the 'do nothing' (no-ban) scenario. We compared these against the 'ban' scenario, all of which are shown in Figure 1 and Figure 2 below and in table format in Annex 1. They show the percentage of the market share forecast to remain plastic over the next 10 years. All of the 'no ban' scenarios are similar in that they suggest that the vast majority of the market for single-use containers will soon move away from plastic towards alternative materials instead.

### **Figure 1: Ban vs no ban scenario forecast of EPS share out of all single use boxes, cups, pots and trays and cones**

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40 Resource Futures (2019), A Preliminary Assessment of the Economic Impacts of a Potential Ban on EPS Food and Beverage Containers, Final Report



Source: Resource Futures and Defra modelling

Based on Resource Futures analysis, we have assumed that EPS items represented 80% of all single-use food and beverage containers which were consumed in 2018.<sup>41</sup> The following assumptions were made in modelling the **no ban** scenario:

- A 5% per annum reduction in the market share of single-use EPS items, driven by voluntary business movement away from single-use plastic.
- Total product sales (both EPS and alternative material single-use items) increase by 3% annually over the 10-year appraisal period. Resource Futures estimate the cited rate as a result of both market growth in the food service sector in terms of market sales and a reduction in the overall use of packaging.<sup>42</sup>

The difference between the ban and no ban central scenario assumptions is used to calculate the best NPV estimate in this impact assessment. We are seeking feedback on these market share assumptions in our consultation.

## End of Life Assumptions

The environmental impact of these products at end of life is determined by how they are disposed. Based on the Resource Futures research<sup>43</sup> and local authority outturn data,<sup>44</sup> it is assumed that the items will be disposed in the following way:

<sup>41</sup> Resource Futures (2019), A Preliminary Assessment of the Economic Impacts of a Potential Ban on EPS Food and Beverage Containers, Final Report

<sup>42</sup> Resource Futures (2019), A Preliminary Assessment of the Economic Impacts of a Potential Ban on EPS Food and Beverage Containers, Final Report

<sup>43</sup> Resource Futures (2019), A Preliminary Assessment of the Economic Impacts of a Potential Ban on EPS Food and Beverage Containers, Final Report

<sup>44</sup> Defra (2017) Statistics on waste managed by local authorities in England in 2016/17. Table 2 Management of all Local Authority collected waste financial year figures in England 2012/13 to 2016/17



**Table 33: Boxes, cups, pots and trays and cones end of life breakdown by material**

	EPS	Paper
Recycled	0.0%	0.0%
EfW	77.0%	71.0%
Landfill	23.0%	28.0%
Commercial composting	0.0%	0.0%
Terrestrial litter	0.5%	0.5%
Beach litter	0.0005%	0.000005%

Note: figures are rounded and so may not sum correctly to totals.

We are seeking input on these assumptions in our consultation.

## Summary of Monetised Costs

### Material Costs

Material cost is the additional cost to economic agents as a result of switching from polystyrene plastic to a plastic alternative. Resource Futures estimate that the unit price of a single-use EPS: box is £0.04, cup is £0.03, pot is £0.02, and trays and cones are £0.03. The report estimates that, under current market conditions, the paper alternatives will be more expensive than their plastic counterparts (£0.14, £0.04, £0.06, and £0.07, respectively). We welcome input in the consultation on whether these unit price assumptions are correct.

We assume that consumers will absorb the majority (i.e. 60%) of the additional costs via higher prices. The uncertainty around this estimate is accounted for in sensitivity analysis, with the low and high cost scenarios (to businesses) assuming 100% and 0% of costs are passed through to consumers. As per RPC guidance<sup>45</sup>, 0% of costs are assumed to be passed through to consumers in the EANDCB (equivalent annual net direct costs to business) calculation. Retailers which sell EPS boxes, cups, pots, trays and cones are expected to pass costs on to consumers in the higher prices charged. Hospitality businesses that choose to provide EPS containers free of charge alongside purchase of food or drink are expected to pass through these variable costs to consumers via general pricing structures, for example by slightly increasing the price of food. We are seeking to supplement the analysis on consumer passthrough costs with more robust evidence on the price elasticity of single-use containers at the final impact assessment,

This cost is by far the largest factor in our analysis. Our conservative approach to analysis does not take into account potential economies of scale that may influence the unit price as a result of a restructured focus of the market following the ban. Material costs makes up 69% of total costs in the 10-year NPV appraisal<sup>46</sup> so any market adaption beyond this very conservative assumption of maintaining the incumbent unit prices will have very significant effects on the final NPV of the policy. We would like to gain stakeholders' views on whether the alternative products' unit price will decrease following a ban on single-use EPS food and beverage containers.

### Monetisation of material costs

<sup>45</sup> Regulatory Policy Committee (2019) *Business Impact Target specific issues: direct versus*

<sup>46</sup> The discounted material costs in the central scenario are £306.4m. The total costs for the central scenario are £445.2m.

The total cost difference to all single-use food and beverage containers (boxes, cups, pots and trays and cones) consumed is estimated by multiplying the unit price difference (£0.10 for boxes, £0.01 for cups, £0.04 for pots and £0.04 for trays and cones) by the total single-use products consumed (central estimate is 219m boxes, 594m cups, 396m pots and 233m trays and cones). This is then multiplied by the difference in both the market share and rate of decline in single use products use under the ban and no ban scenario. The central total net present value over the 10-year appraisal period is £307m.

## Landfill Disposal Emissions Costs

Switching to plastic alternative products can cause an environmental cost at the end of the products lifecycle. Paper items sent to landfill emit more greenhouse gases upon decomposition than plastic products. In our 'end-of-life' assumptions, we assume that a certain percentage of each item goes to landfill. This is reflected in the disposal landfill cost.

There is uncertainty around the scale of these environmental costs due to recent trends of an increasing proportion of municipal waste being sent to incineration<sup>47</sup>. Our estimates may therefore be overestimating the environmental costs associated with paper alternatives to EPS in landfill. We would welcome views in our consultation on these assumptions.

### Monetisation of landfill disposal emissions costs

Table 33 shows how food and beverage containers are treated at the end of their lifecycles. These figures are used to estimate the difference in CO<sub>2</sub>e emissions caused by the landfill disposal of the EPS alternative material products. Polystyrene emits 0.009 CO<sub>2</sub>e per tonne<sup>48</sup>, whereas paper emits 1.042 CO<sub>2</sub>e per tonne. The difference in emissions is then multiplied by the central series carbon value in 2020 prices.<sup>49</sup> This is then multiplied by the difference in both the market share and rate of decline in single-use products used under the ban and no ban scenario, resulting in a central present value of £3.7m over the 10-year appraisal period.

## One-off Capital Investment

Following the implementation of the ban, businesses will either be required to import alternative products, or invest in producing those domestically. Currently, there are four manufacturing factories in the UK which produce single-use EPS food and beverage containers; for simplicity and due to lack of evidence, the analysis assumes that all four plants would move towards manufacture of single-use items made from paper. Resource Futures estimate that the average capital costs associated with switching materials from EPS to paper will be £30m per manufacturing facility.<sup>50</sup>

We welcome evidence on these assumptions at consultation.

### Monetisation of capital investment costs

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47 Tolvik (2021) [UK Energy from Waste Statistics 2020](#)

48 Defra, [Local authority collected waste: annual results tables](#)

49 BEIS, [Valuing greenhouse gas emissions in policy appraisal](#)

50 Resource Futures (2019), A Preliminary Assessment of the Economic Impacts of a Potential Ban on EPS Food and Beverage Containers, Final Report

The central scenario assumes that each of the four domestic manufacturing facilities will incur capital investment costs of £30m. The low scenario (low benefits, high costs) and high scenario (high benefits, low costs) assume that these investment costs would be, respectively, 25% higher and 25% lower than the central estimate.

Assuming that all four manufacturing factories will invest in capital following the implementation of the ban, the central net present value over the ten-year appraisal period is estimated at £127m.

## **Familiarisation Costs**

Familiarisation costs are the one-off transitional costs that businesses face upon the implementation of the ban. This covers the time taken to inform employees about the ban, costs attached to any necessary price changes to products, and time taken to shop around for an alternative supplier.<sup>51</sup>

### **Monetisation of familiarisation costs**

We have monetised these costs using the following figures and assumptions:

Categories of businesses likely to be affected by the ban were identified using Standard Industrialisation Codes (SIC) (see annex 1):

- Instead of using the “Restaurants and mobile food service activities” SIC, we have estimated the number of fast-food restaurants in the UK and used this as an estimate of restaurants impacted by the ban. We have assumed that these enterprises are more likely to use EPS food and beverage containers. Using Public Health England data,<sup>52</sup> we have estimated the number of fast-food restaurants in England.
- Our estimate is that 144,342 businesses will be affected by familiarisation costs in total. Further detail on relevant SIC breakdown is included in annex 1.
- The same businesses will be affected by the ban on single-use EPS pots, boxes and trays and cones. Therefore, although we have analysed on a product-by-product basis, familiarisation costs are calculated only once to avoid double counting. Two additional SIC codes were included in calculations for cups and so we used this familiarisation cost in our calculations since it covers the widest range of SIC codes. As a result, the familiarisation cost is likely an overestimate.

Although there are some businesses that have already transitioned away from single-use EPS food and beverage containers, we have not been able to estimate the number of those businesses at this stage. As such, we have taken a conservative approach and assumed that all identified businesses will experience familiarisation costs.

It was estimated that familiarisation would take 30 minutes of one full time employee’s time under the central sensitivity, with low and high sensitivity estimated to be 15 minutes and one hour, respectively. This was costed at the average hourly wage for each business category<sup>53</sup> plus 22% non-wage labour costs. We are seeking further evidence on this assumption at consultation, as well as views on whether the time required for familiarisation would vary across businesses dependent on their size.

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51 There are no proposed exemptions under this ban. As such, we did not include any on-going familiarisation costs to businesses. This is unlike the IA analysis on banning plastic straws which did include some exemptions and associated on-going familiarisation costs to businesses.

52 PHE, [Fast food outlets: density by local authority in England](#)

53 [Office for National Statistics](#) ‘Earnings and hours worked’, gross hourly pay 2019 (provisional).

To calculate the total familiarisation cost, we multiply the number of enterprises for each SIC by their respective median hourly wage (including 22% non-wage labour costs). We then multiply this by the time burden required by one full time employee per business. This results in a central present value of £1.0m, over the 10-year appraisal period, incurred in full in the first year of the ban.

## Additional Waste Management Costs

Single-use food and beverage containers made of paper weigh more than EPS equivalents. This will increase waste management costs as landfill tax and landfill/incineration gate fees are calculated by weight. Table 4 illustrates the difference in weight by each of the products in scope of the ban.

Local authorities and businesses are expected to share the additional waste management cost burden. Assuming that the majority of single-use EPS items are disposed of in public bins or at home rather than in commercial establishments, we expect businesses and local authorities to bear 10% and 90% of additional waste management costs, respectively.

**Table 4: Table showing the weight comparison, in tonnes and grams, between EPS food and beverage containers and paper food and beverage containers<sup>54</sup>**

Product	EPS weight (tonnes)	Paper weight (tonnes)	EPS weight (grams)	Paper weight (grams)
Boxes	0.00000632	0.0000278	6.32	2.78
Cups	0.00000268	0.00000650	2.68	6.50
Pots	0.00000113	0.00000600	1.13	6.00
Trays and cones	0.00000798	0.0000160	7.98	1.60

## Monetisation of waste management cost

Waste management costs are based on the difference in weight between paper and EPS single-use food and drink containers – calculated via multiplying the weight of each type of item by consumption levels in England. The following assumptions inform the rest of the analysis:

- 99.5% of single-use food and beverage containers are sent for waste treatment at the end of life, regardless of material (as illustrated on Table 3 earlier in the document).
  - 77% of single-use EPS items are incinerated, while the remaining 23% are sent to landfill whereas the respective split for paper items is 71% incinerated and 28% landfilled.

We estimate the cost of single-use EPS and paper containers sent to waste treatment using the current rates of landfill tax,<sup>55</sup> landfill gate fee and incineration gate fee.<sup>56</sup> We then calculate the additional costs from moving to single-use paper rather than EPS items and apportion them between businesses (10%) and local authorities (90%). The resulting 10-year NPV for businesses is estimated at £0.6m. The corresponding 10-year NPV of additional waste management borne by local authorities is £5.2m.

<sup>54</sup> Resource Futures, Economic assessment of a potential ban on expanded polystyrene, 2019

<sup>55</sup> HMRC, Landfill Tax rates

<sup>56</sup> <https://www.letsrecycle.com/prices/efw-landfill-rdf-2/efw-landfill-rdf-2020-gate-fees/>

## Enforcement costs

Enforcement costs relate to the estimated additional burden to 190 Trading Standards Authorities (TSAs) offices across England<sup>57</sup> which will enforce the policy (many respondents to the straws consultation<sup>58</sup> proposed that the TSAs would be best placed to enforce the straws ban). We have estimated that the single-use EPS food and beverage container ban will occupy 3.5 days of the officer's time per year at £149 day rate. Given the level of uncertainty around this time burden, we have set a low sensitivity at 3 days and a high sensitivity at 4 days. We will seek views on this at consultation.

### Monetisation of enforcement cost

The enforcement costs are calculated by multiplying the number of TSAs in England enforcing the policy by the time burden required from each Authority's officer. This is then multiplied by the median daily wage rate of Trading Standards Officers. (including 22% non-wage labour costs and 1.5% annual growth).

Similarly to the familiarisation costs, boxes, cups, pots, trays and cones are treated as complimentary goods. As such, we have assumed that reports of instances in which one type of single-use EPS item is being incorrectly sold and/or supplied to customers will likely be accompanied by other types as well. Therefore, the estimated enforcement costs are shared across both products. This also helps to avoid double counting. The central present value of the enforcement cost over the 10-year appraisal period is £0.6m.

## Fuel costs

Our research has shown that EPS food and beverage containers are lighter than the paper alternative. Additional weight requires more fuel to transport.

Several important factors are unknown, which make it difficult to form a reliable estimate of these costs, such as:

- The average distance travelled by each food and beverage container in England;
- The number of food and beverage containers carried on average in a lorry/ van;
- The mode or modes of transport and the vehicles used;
- The fuel cost of the additional weight per mile, which will depend on the mode of transport and the weight a vehicle is already transporting

### Monetisation of fuel cost

The Massachusetts Institute of Technology found that if a light truck's load is reduced by 10kg, assuming a \$1 per litre fuel price, \$80 is saved over 200,000km.<sup>59</sup> To adapt to the analysis, the recent fuel prices and exchange rate were applied and the mean distance travelled by products was assumed at 100km. Multiplying the unit weight difference by the total consumption for each single-use EPS product item gives the total additional weight caused by the ban per year. The next step was

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57 22 TSA in Wales <https://www.tradingstandardswales.org.uk/about/>, 190 in England and 32 in Scotland based on number of Unitary Councils <https://lgiu.org/local-government-facts-and-figures-england/>, 5 Trading Standards Service offices in Northern Ireland <https://www.inputyouth.co.uk/tradingstandards.html>.

58 Consultation Stage Impact Assessment on the proposal to ban the distribution and/or sale and of plastic drinking straws in England  
59 <http://www.nrcan.gc.ca/node/16755>

to multiply the additional weight by the savings over 100km, and adjust it by the difference in both the market share and rate of decline in single-use containers use under the ban and no ban scenarios. The central present value of the cost over the 10-year appraisal period is £0.5m.

We welcome views at consultation on our assumption of 100km as average logistical distance travelled.

## **Fuel Emission Costs**

In addition to fuel costs to businesses (which have been included in the NPV and EANDCB calculations), the use of more fuel would incur additional greenhouse gas emissions.

### **Monetisation of fuel emissions cost**

The cost of fuel emissions was estimated using the amounts for additional litres of fuel used, as calculated above. Using an average of 2.4 kg CO<sub>2</sub>e per litre of diesel burned<sup>60</sup> generates the CO<sub>2</sub>e emissions from the additional fuel consumption. We then monetised this using Green Book carbon prices,<sup>61</sup> this would be worth £0.2m discounted over 10 years.

## **Summary of Monetised Benefits**

### **Production Emissions Savings**

Single-use paper food and beverage containers are much less emission intensive to produce than EPS equivalents. We have assumed that 95% of the food and beverage container markets are supplied by domestic manufacturers.<sup>62</sup> This means that the ban will deliver some production-related emissions savings. The estimation of domestic production is something we would like to get stakeholder views on in our consultation.

### **Monetisation of production emissions savings benefit**

The decrease in emissions during production can be monetised using government carbon prices. These benefits are estimated as follows:

- Polystyrene is associated with 2.306 tonnes of CO<sub>2</sub>e per tonne of material production.
- We have estimated the total number of single-use food and beverage containers in England. This was based on the total number of products consumed multiplied by the domestic share of the market (95%).
- This is multiplied by the respective unit weights of the product to find total tonnage of each product produced domestically. Total tonnage is then multiplied by the emission per tonne of the EPS and paper material. The difference between the emissions resulting from the EPS

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60 BEIS, [Valuing greenhouse gas emissions in policy appraisal](#)

61 BEIS, [Valuing greenhouse gas emissions in policy appraisal](#)

62 Resource Futures, Defra plastic ban EPS food and beverage containers, 2019

food and beverage container production and the paper food and beverage container production is the production emission savings benefit.

The production emission savings result in a central present value saving of £14.8m over the 10-year appraisal period.

## **Disposal Incineration Emissions Benefit**

Our model assumes that 77% of EPS products and 71% of paper products are incinerated. Paper is less carbon intensive to incinerate than EPS due to the energy that is derived from waste. Each tonne of paper burnt saves carbon dioxide equivalent emissions (CO<sub>2</sub>e).

### **Monetisation of disposal incineration emissions benefit**

To calculate the incineration benefit, we estimate the difference in tonnes of CO<sub>2</sub>e between the emissions released upon incineration of the EPS items (0.642 CO<sub>2</sub>e per tonne of material incinerated) and the emissions released (which are actually negative due to the energy gained from incineration) upon incineration of the alternative material product (-0.331 CO<sub>2</sub>e per tonne of material incinerated).<sup>63</sup> We then multiply the difference in emissions from incineration by the carbon value.<sup>64</sup>

Finally, we adjust this value by the change in the market share and by the difference in the rate of decline in single-use EPS containers under the ban and no ban scenario. The benefit results in a central present value of £10.4m over the appraisal period.

## **Reduced Coastal Clean-up Costs**

The implementation of the ban on EPS food and beverage containers is predicted to reduce marine litter clean-up costs to local authorities. The faster decomposition rates of plastic alternatives mean that these items will be present on beaches for less time. This means there will be fewer litter items to be cleared over time in harbours and beaches. There are no savings associated with street litter collection as these items are often cleaned up before they decompose.

### **Monetisation of reduced coastal clean-up costs**

Harbours and marinas have litter cleared in order to ensure that their facilities remain clean, safe and attractive for users. Mouat et al. (2010)<sup>65</sup> estimated that UK municipalities spend approximately £15.5 million each year removing all forms of beach litter, and £2.1 million each year on harbours. The contribution of each product to total beach litter (0.74% for boxes, 0.24% for cups, 0.09% for pots and 0.74% for trays and cones) is based on item count in beach litter surveys carried out by Nelms et al (2017).<sup>66</sup>

Paper has a much faster decomposition rate in comparison to EPS. We calculated these rates based on the assumption that the marine decomposition of a polystyrene cup is between 50-500 years<sup>67</sup>. This is a large range but reflects the fact that rates vary according to oxygen, light and moisture levels.

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63 BEIS, [Greenhouse gas reporting: conversion factors](#)

64 BEIS, [Valuing greenhouse gas emissions in policy appraisal](#)

65 Mouat, Lozano, Bateson: Economic Impacts of Marine Litter, 2010. Figure based on exchange rate of £1 = EUR 1.16

66 Nelms et al. (2017) Marine anthropogenic litter on British beaches: A 10-year nationwide assessment using citizen science data, . We assume plates make up 0.25% of 3 "ambiguous" plastic categories in the MCS data. We assume cutlery makes up 5% of "cutlery/trays/straws/cups".

67 <https://alansfactoryoutlet.com/how-long-does-it-take-plastics-to-break-down/>

We divided this by the weight of an EPS cup in order to obtain an EPS decomposition rate, which we then multiplied by the weights of the other products in order to obtain the figures in the table below.

**Table 5: Time taken for food and beverage containers to decompose in a marine environment.**

Product	EPS (years)	Paper (years)
Boxes	649	0.5
Cups	275	0.115
Pots	116	0.11
Trays and cones	819	0.3

The above numbers were used to calculate the decomposition ratios below.

**Table 6: Ratio of decomposition of paper to EPS**

Product	Decomposition ratio
Boxes	0.08%
Cups	0.04%
Pots	0.09%
Trays and cones	0.03%

This gives us an estimate of marine litter reduction as a result of using alternative materials.

We then multiplied this estimate by the total annual litter clean-up cost in beaches and harbours (£17,552,917)<sup>68</sup>. We have also taken into account that only 65%<sup>69</sup> of the total cost are assumed to be variable.

Finally, reduced clean-up costs are adjusted to reflect the difference in the market share associated reductions in the volume of sales under the ban and no ban scenario (i.e. counterfactual). This results in a central present value benefit of £1.4m over the appraisal period.

## Beach wellbeing benefit

According to a survey by Populus,<sup>70</sup> 89% of people are concerned by plastic pollution in the ocean. The presence of litter can contribute to a fear of crime and injury, both of which have a negative wellbeing impact. Litter can also discourage the use of public spaces and reduce our enjoyment of marine environments. There is a negative well-being impact experienced when harm to marine environments and the wildlife in them is observed. Clean environments have a value to people who care for the welfare of wildlife and other people, and littered environments affect people's sense of safety, enjoyment and willingness to use public spaces. Therefore, there is a social disamenity cost associated with litter.

68 [http://www.kimointernational.org/wp/wp-content/uploads/2017/09/KIMO\\_Economic-Impacts-of-Marine-Litter.pdf](http://www.kimointernational.org/wp/wp-content/uploads/2017/09/KIMO_Economic-Impacts-of-Marine-Litter.pdf)

Beach litter clean-up costs the UK EUR 18 million. We converted this using the 21/05/2021 exchange rate (£1 = 1.1622 EUR) to obtain a cost of £15,487,868.

Harbour litter clean-up costs the UK EUR 2.4 million. We converted this using the 21/05/2021 exchange rate (£1 = 1.1622 EUR) to obtain a cost of £2,065,049.

69 LA Revenue outturn <https://www.gov.uk/government/statistics/local-authority-revenue-expenditure-and-financing-england-2018-to-2019-individual-local-authority-data-outturn> This is England data. We assume that the UK will have the same variable cost share.

70 [Populus: Ocean Plastic Survey](#)



A ban on EPS boxes, cups, pots and trays and cones is expected to have a positive amenity benefit by reducing the amount of single-use plastic in circulation and littered. Even if they still end up in the marine environment, paper decomposes much faster. This will lead to fewer of them being found across all environments as litter. This amenity benefit is generated because people may gain a satisfaction from knowing that something is being done to support marine environments.

### **Monetisation of beach wellbeing benefit**

This area is difficult to monetise directly, so we have used a willingness to pay method:

- An Eftec survey<sup>71</sup> found, after surveying 809 people with a mix of beach and non-beach users, a mean willingness to pay of £8.50<sup>72</sup> per household for clean beaches. Based on 23,274,000 households in England<sup>73</sup>, we estimated that the total beach disamenity cost of litter is £791m per annum for the four product groups under consideration.
- The percentages in **Table 6** reflect the fact that paper food and beverage containers will be present in the marine environment for a significantly shorter period of time than EPS, leading to fewer items found. They give us an estimate of marine litter reduction as a result of using alternative materials.
- We then multiplied the decomposition rates by the estimated proportion of EPS that contributes to beach litter and the total beach disamenity cost.

This results in a central present value of £28.7 million over the appraisal period.

## **Non-monetised costs and benefits**

### **Summary of non-monetised costs**

#### **Public sector familiarisation costs**

A potential cost that we have not been able to monetise is the familiarisation costs to public sector organisations. There might be several organisations such as schools, hospitals and prisons that use single-use EPS food and beverage containers and would be affected by the proposed ban. We know, for example, that the NHS are already transitioning away from single use plastics<sup>74</sup>.

This public sector cost omission would only affect familiarisation costs and not the other areas of costs and benefits. This is because we assume that any food and beverage containers used by the public sector are implicitly captured in the total England food and beverage consumption data. They will therefore be factored in calculations related to other costs and benefits identified in this IA. Whether public sector organisations use food and beverage containers is something we would like to gain stakeholders' views on in the consultation.

#### **Lost revenue for producers**

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71 Eftec (2002), Valuation of Benefits to England and Wales of a Revised Bathing Water Quality Directive and Other Beach Characteristics Using the Choice Experiment Methodology

72 A range of £6 to £11 per household was given in the survey. We have used the mean value of this for calculations.

73 ONS (2019) Families and households

74 <https://www.england.nhs.uk/2019/10/nhs-bids-to-cut-up-to-100-million-plastic-straws-cups-and-cutlery-from-hospitals/>

Another possible cost that we have not monetised is the loss in revenue and associated profits from lost domestic production of EPS food and beverage containers. Our assumption, based on Resource Futures' research<sup>75</sup>, is that 95% of EPS food container boxes are produced in the UK.

There may also be an additional cost to businesses if they decide to adapt their production to use alternative materials. They may incur a significant cost if alternative material production will require different capital inputs.

We welcome evidence on the response of producers of single use food and beverage containers in the public consultation. We also plan to engage with the relevant industry bodies and third parties to better understand the domestic production landscape for these items.

## Summary of non-monetised benefits

### Reduced damage to marine life

Plastics are the largest, most harmful and most persistent fraction of marine litter, accounting for at least 85 per cent of total marine waste.<sup>76</sup>

It is estimated that 1.5–4.5% of all global plastics production ends up in the ocean every year<sup>77</sup>. These items can break down and be ingested by marine life up and down the food chain. Nearly 700 marine species are affected by plastic ingestion and entanglement<sup>78</sup>. It has been estimated that 50% of marine mammals, 40% of seabirds and all turtle species have been known to ingest plastic<sup>79</sup>. Plastic can be retained in animals' stomachs and can impede dietary habits, either by making them feel full and therefore preventing them from eating, or by impeding their digestion, resulting in malnutrition and eventual starvation<sup>80</sup>. Furthermore, microplastics can absorb harmful substances such as endocrine disrupting chemicals (EDCs) that can disrupt the hormonal equilibrium of marine life<sup>81</sup>. When microplastics are ingested, they can cause changes in gene and protein expression, inflammation, disruption of feeding behaviour, decreases in growth, changes in brain development, and reduced filtration and respiration rates. Microplastics also act as vectors for pathogenic organisms harmful to humans, fish and aquaculture stocks.<sup>82</sup>

Plastics can also alter global carbon cycling through their effect on plankton and primary production in marine, freshwater and terrestrial systems. Marine ecosystems, especially mangroves, seagrasses, corals and salt marshes, play a major role in sequestering carbon. By damaging oceans and coastal areas, it becomes harder for these ecosystems to both offset and remain resilient to climate change.<sup>83</sup>

Furthermore, research is gradually revealing the impact that this marine plastic pollution could have on human health. When marine life ingests plastic, the toxins in microplastics can be transferred up the food chain and can be ingested by humans<sup>84</sup>. Human uptake of microplastics via seafood is likely to pose serious threats to coastal and indigenous communities where marine species are the main source of food. The human consumption of microplastics has been documented by many studies in

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75 Resource Futures for Defra

76 From Pollution to Solution: Marine Litter and Plastic Pollution Global Assessment, UNEP, 2021

77 <http://www.sciencemag.org/news/2015/02/here-s-how-much-plastic-enters-ocean-each-year>

78 [https://www.biologicaldiversity.org/campaigns/ocean\\_plastics/](https://www.biologicaldiversity.org/campaigns/ocean_plastics/)

79 Estimates from Centre for Environment, Fisheries & Aquaculture Science

80 [Cotton bud project](#)

81 Chen et al (2019) <https://www.sciencedirect.com/science/article/pii/S0160412019303137>

82 From Pollution to Solution: Marine Litter and Plastic Pollution Global Assessment, UNEP, 2021

83 From Pollution to Solution: Marine Litter and Plastic Pollution Global Assessment, UNEP, 2021

84 <https://www.nationalgeographic.com/news/2017/08/ocean-life-eats-plastic-larvaceans-anchovy-environment/>

recent years, but the impact of human microplastic consumption is still unclear<sup>85</sup> <sup>86</sup>. However, some of these chemicals are associated with serious health impacts, especially in women.<sup>87</sup>

Given that EPS food and beverage containers contribute to marine litter<sup>88</sup>, the ban on these items will contribute to the reduction of marine plastic pollution which will in turn help reduce the damage to marine life, including fisheries.

The global plastic market in 2020 has been estimated at around US\$ 580 billion (432 billion GBP)<sup>89</sup> while the monetary value of losses of marine natural capital is estimated to be as high as US\$ 2,500 billion per year (1,860 billion GBP)<sup>90</sup>. The European commission<sup>91</sup> estimated that the cost of marine litter to the EU fishing industry could amount to almost €60 million. We have not quantified the effect the ban would have on reducing these costs as it is not clear the extent to which EPS food and beverage containers contribute to fishery damage, but even a small contribution by EPS food and beverage containers could cost thousands or millions of pounds each year, which could be prevented under a ban.

## Risks

### Risk surrounding imposing a ban

- **Increase in littering:** There is a risk that a change in material may encourage consumers to believe that the consequences of not disposing of EPS food service items correctly will be reduced and that therefore consumers may litter more or not recycle them as frequently. However, we expect that the ban will raise people's awareness of the environmental damage single use plastic items can cause, and that consumers will therefore dispose of them correctly.

### Risks surrounding not imposing a ban

- **Environmental costs get worse:** If we don't place a ban the environmental impacts including harm to marine wildlife may worsen and possibly at a non-linear rate.
- **Commitments not met:** The ban forces retailers to adhere to the voluntary commitments many have already made towards switching to alternative materials for food service items. If a ban is not imposed, retailers may fall back on or delay commitments they have made.
- **Consumers keep choosing plastic:** There is a risk that consumers will still opt for EPS food service items without a ban. They could do so inadvertently if products are not well labelled, or consumers may find that they prefer EPS food service items. It may be that there is a time inconsistency problem where consumers state that they should not use EPS items because of their associated environmental harms, but upon purchase they discount future and indirect environmental costs too strongly in favour of a plastic product that they may prefer to use now.

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85 World Health Organisation (2019)

86 Cox et al, 2019, Human consumption of microplastics <https://pubs.acs.org/doi/abs/10.1021/acs.est.9b01517>

87 From Pollution to Solution: Marine Litter and Plastic Pollution Global Assessment, UNEP, 2021

88 EU described plates and cutlery as in the top ten single use plastics littered in marine environments [https://ec.europa.eu/commission/presscorner/detail/en/MEMO\\_18\\_3909](https://ec.europa.eu/commission/presscorner/detail/en/MEMO_18_3909)

89 Exchange rate value as of 17th November 2021

90 Exchange rate value as of 17th November 2021

91 European Commission, [Our Oceans, Seas and Coasts](#)

## **Equalities Impact Assessment**

The public sector equality act introduced the requirement for public bodies to assess whether policy proposals will unlawfully discriminate against a group of people. We believe that the ban on single-use expanded polystyrene food service items will not unlawfully discriminate against any group of people.

We are inviting views on this at consultation.

## **Small and Micro Businesses Assessment (SaMBA)**

We expect the predominant users of single-use EPS items are small and micro sized businesses in the foodservice sector (annex 2), such as chicken takeaways, burger and kebab shops, curry houses and fish and chip shops. However, we do not currently have evidence to quantify the extent to which they may be disproportionately affected by the ban and we expect the ban might both positively and negatively impact businesses. For example, while direct increases in material costs will fall on businesses switching from EPS to alternative materials, the businesses may in turn experience increased demand from consumers who favour non-EPS packaging. The ban may therefore create a level playing field in which consumer preferences on problematic plastics is no longer a factor in the choice of foodservice outlet to visit.

Small and micro businesses might also face proportionally higher costs, compared to larger businesses, due to economies of scale. This might occur through larger businesses being able to purchase higher quantities of item at a lower cost. Alternatively, in a small or micro business, a larger proportion of time would be needed to understand the implications of the ban compared to larger businesses, where information can be cascaded more efficiently. We are seeking to gain further evidence on this in the consultation published alongside this document. As noted in the discussion on familiarisation costs, the consultation also seeks evidence on whether small and micro businesses would require a different amount of lead-in time for employees to become aware of the ban.

Whilst there will be familiarisation costs to businesses, a ban serves as an advantage from an information point since it reduces the need for businesses (including SME's) to gain information on best packaging and consumer preferences.

We think that exempting small businesses would invalidate the purpose of the policy due to the predominance of small and micro businesses using single-use EPS. Assuming that the majority is used by foodservice businesses, in the UK 98% of restaurants and mobile food service activities (SIC 5610) are small or micro businesses (see Annex 2). Therefore, exempting these businesses would mean that the majority of the potential benefits from a ban on single-use EPS items would not be realised. We may be able to mitigate some of the disproportionate impacts on small and micro businesses through clarity of messaging of the ban and targeted communications.

## **Monitoring and Evaluation**

The effect of this policy will be reviewed in line with the standard 5-year post implementation review process.

### **Current monitoring arrangements**

Monitoring change is focused on our intended outcomes, namely reductions in resource use and waste production and improvements in waste management (more recycling, less landfilling and less waste crime). The changes are part of a 'golden thread' which leads upwards to the objectives of the 25 Year Environment Plan, the Clean Growth Strategy, and the Litter Strategy. The framework of indicators is set out on page 139 of the Resources and Waste Strategy

The framework was devised prior to the focus on Net Zero, to which all three 25YEP goals are relevant. We have set out our approach to monitoring change in our *Monitoring Progress* report.<sup>67</sup>

### **Current data collection regimes**

Data on waste is limited, something we are addressing through our work on a) mandatory reporting on food waste and b) waste tracking. Both are due to be implemented, subject to consultation and legislative change, in the next couple of years. In the meantime, we rely on the Defra-funded WasteDataFlow reporting platform for local authority collected waste, on work delivered by WRAP, on our own in-house models (MELMOD and FOWST), and on bespoke Defra-funded measurement initiatives.

### **Proposed monitoring arrangements**

We have devised a series of high-level theories of change from which a sub-set of SMART indicators will be selected. We expect that we will currently be collecting some of these, but that we will need to define and collect data on additional indicators relevant to specific policy initiatives.

We also plan to expand our routine monitoring from the high-level indicators shown above to a) material-based indicators e.g. plastic waste and b) lead indicators of change, e.g. shifting patterns of behaviour. These will be reported in future editions of the annual *Monitoring Progress* report.

Both activities are elements of an external commission for evaluation of the Resources and Waste Strategy which we expect to start in early 2022. We have approval to start the procurement process, which we will be initiating in autumn 2021.

### **External influencing factors**

The context within which the ban on single-use plastic plates and cutlery will be implemented is extremely complex, with many interacting parts, policies and actors. The complexity supplement to the Magenta Book is helpful in this respect and will be the basis of evaluation commissioning.

Key factors which may influence the outcome of the ban, which are not under our control, include:

- Disproportionate impacts on groups through a protected characteristic under the Equality Act 2010;
- Disproportionate impacts on small and micro-sized businesses;
- Falling demand for single-use EPS food and beverage containers in favour of reusable alternatives.

We will ensure that evaluation takes account not only of our own activities but also those of other actors. Similarly, we will ensure that we look for unintended outcomes as well as intended outcomes, and that we assess both benefits and disbenefits, as whether an outcome is felt as a 'good' or 'bad' thing depends on who is affected, how and when.

### **Early indications that policies are not working as intended**

We intend to commission both an impact evaluation and a process evaluation. The process evaluation will be carried out in parallel to policy implementation, to help us understand what is and is not working, get feedback from stakeholders and make corrections to design, implementation and regulation if needed. It will provide evidence on the effectiveness of the ban on single-use EPS food and beverage containers in the face of external criticism, but also enable us to quickly stop policies which are not working as intended, or which may be causing hardship.

### **Performance evaluation**

The impact evaluation we are commissioning will enable us to make a formal assessment of policy performance compared with expectations. We intend to build in a way of quantifying attribution, so we can distinguish, quantitatively, the impact of the ban as distinct from other factors while recognising the system interactions that mean it is rarely the case that a single policy leads to a single outcome.

The impact evaluation will gather quantitative and qualitative evidence about the difference the ban is making, which aspects are working, which are not working so well, and recommendations for future improvements. Following from this, we will be able to use the data to estimate cost-benefits and to satisfy any commitments we have made to carry out formal reviews.

## Annexes

### Annex 1: Number of local business units in England assumed to be affected by a ban

SIC code	England local business units
4711 : Retail sale in non-specialised stores with food; beverages or tobacco predominating	<b>40,060</b>
4719 : Other retail sale in non-specialised stores	<b>12,620</b>
4729 : Other retail sale of food in specialised stores	<b>4,575</b>
4781 : Retail sale via stalls and markets of food; beverages and tobacco products	<b>1,095</b>
5530 : Camping grounds; recreational vehicle parks and trailer parks	<b>2,135</b>
5610 : Restaurants and mobile food service activities	<b>53,087</b>
5621 : Event catering activities	<b>15,320</b>
5629 : Other food service activities	<b>15,450</b>
5630 : Beverage serving activities	<b>39,090</b>
<b>Total</b>	<b>144,342</b>

### Annex 2: Number of VAT and/or PAYE based local units by Standard Industrial Classification class by employment size bands, UK 2020<sup>92</sup>

SIC code	Employment Size Band							Total
	0-4	5-9	10-19	20-49	50-99	100-249	250+	
4711 : Retail sale in non-specialised stores with food; beverages or tobacco predominating	22240	7990	9150	5695	810	1565	810	<b>48260</b>
4719 : Other retail sale in non-specialised stores	5640	2890	2735	2615	845	185	65	<b>14975</b>
4729 : Other retail sale of food in specialised stores	3215	1385	515	185	30	10	0	<b>5340</b>
4781 : Retail sale via stalls and markets of food; beverages and tobacco products	935	200	40	10	0	0	0	<b>1185</b>
5530 : Camping grounds; recreational vehicle parks and trailer parks	1880	545	260	155	100	60	20	<b>3020</b>
5610 : Restaurants and mobile food service activities	49275	27690	17880	10255	1630	855	45	<b>107630</b>
5621 : Event catering activities	11075	3415	1710	845	235	90	50	<b>17420</b>
5629 : Other food service activities	9395	4430	2030	845	170	70	45	<b>16985</b>
5630 : Beverage serving activities	15710	11690	10435	7420	780	75	5	<b>46115</b>

<sup>92</sup> ONS, [UK business: activity, size and location](#)

<b>Total</b>	<b>119365</b>	<b>60235</b>	<b>44755</b>	<b>28025</b>	<b>4600</b>	<b>2910</b>	<b>1040</b>	<b>260930</b>
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