

Title: Impact Assessment on the proposal to ban the supply of single-use food and beverage containers made from expanded or extruded polystyrene in England IA No: RPC Reference No: Lead department or agency: Department for Environment, Food and Rural Affairs (Defra) Other departments or agencies: N/A	Impact Assessment (IA)
	Date: 21/04/2023
	Stage: Final stage
	Source of intervention: Domestic
	Type of measure: Secondary legislation
Contact for enquiries: Louisa Fenocchi or Daniel Edwards	

Summary: Intervention and Options	RPC Opinion: GREEN
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Cost of Preferred Option (2019 prices, 2020 present value)

Total Net Present Value	Business Net Present Value	Net cost to business per year	Business Impact Target Status
-£76.7m	-£87.9m	£10.2m	Qualifying provision?
			Qualifying provision

What is the problem under consideration? Why is government intervention necessary?

Single-use expanded and extruded polystyrene (EPS) food and beverage containers are not commonly recycled or re-used and cause multiple negative environmental externalities, particularly when they are discarded incorrectly.¹ These include harm to marine environments, cost to local authorities and visual pollution. As these items are not commonly recycled in the UK² even if disposed of correctly, it is likely they will end up being incinerated at end of life³, generating additional greenhouse gas emissions in addition to those released during production. These negative externalities are experienced across society and are not accounted for within the market price of the items. Government intervention could shift the EPS food and beverage container market to reusable or plastic-free alternatives that impose fewer externalities, and ensure the change and environmental benefits are sustained into the future.

What are the policy objectives and the intended effects?

The key objective is to reduce the volume of plastic entering the natural environment, to reduce the global harm imposed by plastic pollution. This will help protect our environment for future generations, improve environmental quality and reduce harms to human health and biodiversity. The intervention will contribute to the Government's 25 Year Environmental Plan commitment to eliminate avoidable plastic waste by 2042. The ban may encourage businesses in England to invest in environmentally friendly alternatives to plastic. The ban may encourage increased use of re-usable alternatives to the single-use plastic items. The ban may help to reduce the amount of non-renewable resources used to produce the banned items.

What policy options have been considered, including any alternatives to regulation? Please justify preferred option

Several options have been considered, including taxes/charges, subsidies and information campaigns. Our final stage analysis is focussed on two central options: 'do nothing' (option 0), and a ban on the supply (option 1, preferred). A ban would have the maximum impact in reducing the social and environmental costs of single-use EPS food and beverage containers and averts the currently unquantified risk posed by the items when they escape into the environment. The impacts of a ban are proportionate to secure the environmental benefits without major costs. The current trend in the market for single-use food and beverage containers has already begun to shift away from EPS and alternative materials are readily available; however, this change is not happening at a sufficient speed or scale. When considering alternative options such as information and education, request only options, subsidies, and taxation and charges, we have drawn on Defra's previous work on single-use plastic items. Alternative options, both regulatory and non-regulatory, were ruled out in favour of a ban, in order to maximise the environmental and social benefits from reduced EPS food and beverage containers consumption and ensure these benefits are realised as soon as possible.

¹ Resource futures (2018) [A preliminary assessment of the economic impacts of a potential ban on expanded polystyrene food and beverage containers](#)

² WRAP (2021) [Eliminating Problem Plastics](#)

³ Resource futures (2018) [A preliminary assessment of the economic impacts of a potential ban on expanded polystyrene food and beverage containers](#)

Will the policy be reviewed? It **will** be reviewed. **If applicable, set review date:** 5 years post implementation

Is this measure likely to impact on international trade and investment?

Yes

Are any of these organisations in scope?

Micro
Yes

Small
Yes

Medium
Yes

Large
Yes

What is the CO₂ equivalent change in greenhouse gas emissions?
(million tonnes CO₂ equivalent)

- 0.0020Mt CO₂e

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 Minister:

Rebecca Pow

Date: 23 May 2023

Summary: Analysis & Evidence

Policy Option 1

Description: Ban on the supply of single-use EPS 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: -£172.6	High: -£38.4	Best Estimate: -£90.2

COSTS (£m)	Total Transition (Constant Price) Years		Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	33.0	1 years	3.4	61.3
High	131.4		5.8	180.5
Best Estimate	66.1		4.6	104.7

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

The largest cost is due to producers investing in capital to adapt production processes. Another large cost is due to the wholesale price of the assumed alternative material items being greater than the wholesale price of single-use plastic items. This is a direct cost to businesses. Businesses will also incur familiarisation costs and additional fuel costs, resulting from alternative material items being heavier than plastic equivalents. Producers will incur a loss of profits from no longer producing single-use EPS food and beverage containers. There are environmental costs which arise when alternative material items are sent to landfill, as biodegradable waste produces methane when undergoing anaerobic degradation in landfill. 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 using single-use EPS food and beverage containers rather than items made from paper or other non-EPS material. The policy may lead to a fall in the demand or supply of single-use items altogether in favour of reusable items which may be made from more durable plastic. However, alternatives meant to be used multiple times may continue to be used only once before disposal. Wholesalers of the banned items may incur some costs, particularly during the transition to alternative material items.

BENEFITS (£m)	Total Transition (Constant Price) Years		Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	0.0	10 years	1.0	7.9
High	0.0		2.8	22.8
Best Estimate	0.0		1.8	14.4

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

As the alternative materials modelled decompose at a much faster rate than plastic, we expect to see a reduction in the presence of litter on beaches, reducing clean up costs for beaches. A similar fall in the presence of litter is also expected terrestrially on streets and green spaces. Cleaner beaches, streets and green spaces are highly valued by the public. Food and beverage containers made from alternative materials, assumed to be paper in this IA, are less carbon intensive in production⁴ and incineration⁵ than plastic, and can be more easily recycled, resulting in environmental savings.

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

There are benefits which have not been proportionate to monetise. EPS food and beverage containers are a source of litter which impacts wildlife as materials can entangle or be ingested by wildlife, causing injury and loss of life especially to marine animals.⁶ Plastic breaks down slowly over time and can persist as microplastics for a substantial period of time. Microplastic ingestion by animals has been shown to reduce food consumption and therefore energy levels in animal life⁷ and can be passed along the food chain to other animals and humans. Preliminary studies have indicated that microplastics negatively impact human health, but the scale of this harm is currently unquantified.⁸

Key assumptions/sensitivities/risks	Discount rate (%)	3.5%
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⁴ BEIS, Greenhouse Gas Reporting Conversion Factors

⁵ WRAP (2021) [Carbon Waste and Resources Metric](#)

⁶ Kühn, S., Bravo Rebolledo, E.L., van Franeker, J.A. (2015). [Deleterious Effects of Litter on Marine Life](#). In: Bergmann, M., Gutow, L., Klages, M. (eds) [Marine Anthropogenic Litter](#).

⁷ University of Exeter (2014) [The Impact of Microplastics on Marine Life](#)

⁸ World Health Organisation (2019) [Microplastics in Drinking Water](#)
Cox et al (2019) [Human consumption of microplastics](#)

Due to existing industry commitments, food and beverage containers made from EPS already represent a very small proportion of the overall market for these items – we assume that the market share for EPS plateaus at 5% throughout the appraisal period. We assume paper will be the replacement material for EPS, due to current usage and trends in replacing plastic. Costs may fall if prices of paper food and beverage containers decreases as scale of production increases.

BUSINESS ASSESSMENT (Option 1)

Direct impact on business (Equivalent Annual) £m:			Score for Business Impact Target (qualifying provisions only) £m:
Costs: 12.0	Benefits: 0.0	Net: 12.0	
			51.1

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Problem Under Consideration

Single-use food and beverage containers made from expanded or extruded polystyrene (EPS) are environmentally damaging, especially to marine environments.⁹

Plastic production (including EPS) predominantly depends on finite fossil fuels and as such uses non-renewable resources. In addition, polystyrene items do not biodegrade or photodegrade; EPS items 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 these single-use items negatively impacts wellbeing¹⁰ and generates clean-up costs to local authorities. It is estimated that UK municipalities spend approximately £15.8m each year to remove all forms of beach litter.¹¹ Single-use EPS food and beverage containers are often littered in parks and public spaces; these items can then be transferred to the marine environment through sewerage and storm drainage. This contributes to the global marine plastic problem, damaging the marine environment and posing a risk to wildlife – 80% of terrestrial plastic litter ends up in the marine environment.¹² Single-use EPS food and beverage containers can also be littered directly into the marine environment by marine users and visitors to coastal areas. The Marine Conservation Society's Great British Beach Clean 2022 indicates plastic/polystyrene pieces are the most frequently counted litter item on UK beaches.¹³ Another study by the European Environment Agency found plastic and polystyrene pieces to be the second most commonly littered items across Europe's marine environments¹⁴. It is estimated that there are over 150 million tonnes of plastic in the world's oceans¹⁵; furthermore, by 2050, it is predicted that oceans will contain more plastic than fish (by weight) if no action is taken to curb the flow of plastic into waterways.¹⁶ Estimates also suggest that every year 1,000,000 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.^{17,18}

At end of life, EPS food and beverage containers are often disposed of in ways that don't lead to the best environmental outcome. Whilst clean single-use EPS items can technically be recycled, this is not a widespread practice in the UK due to lack of appropriate infrastructure.¹⁹ In addition, as the material is lightweight and dispersed, EPS is inherently costly to collect and contamination renders items useless to reprocessors. As a result, single-use EPS items are typically not recycled due to the effort required to separate 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 causes little change in consumer experience whilst reducing environmental impacts.

⁹ Resource futures (2018) [A preliminary assessment of the economic impacts of a potential ban on expanded polystyrene food and beverage containers](#)

¹⁰ Lorenc, T., Petticrew, M., Whitehead, M. *et al* (2013) [Fear of crime and the environment: systematic review of UK qualitative evidence. BMC Public Health 13, 496](#)

¹¹ Mouat, Lozano, Bateson (2010) [Economic Impacts of Marine Litter](#). Figure based on exchange rate of £1 = EUR 1.14

¹² Eunomia (2016) [Plastics in the Marine Environment](#)

¹³ Marine Conservation Society: [The Great British Clean](#)

¹⁴ European Environment Agency [Citizen's collect plastic and data to protect Europe's marine environment](#)

¹⁵ Science Daily (2015) [An ocean of plastic: Magnitude of plastic waste going into the ocean calculated](#)

¹⁶ Ellen MacArthur Foundation (2017) [The New Plastics Economy: Rethinking the Future of Plastics and Catalysing Action](#)

¹⁷ Thompson, R.C., *et al.* (2009) [Plastics, the environment and human health: current consensus and future trends. Philosophical Transactions of the Royal Society B: Biological Sciences](#)

¹⁸ Mouat, Lozano, Bateson (2010) [Economic Impacts of Marine Litter](#).

¹⁹ WRAP (2022) [Eliminating Problem Plastics](#)

Rationale for Intervention

There is a market failure due to the market price of EPS food and beverage containers not accounting for any of the negative impacts of production and disposal, therefore creating negative externalities. As such, businesses and end-consumers are not currently incentivised to limit their use or to switch to items made of less environmentally harmful materials. Intervention is required to ensure a full shift in the food and beverage container market away from EPS. This will maximise the associated environmental benefits and ensure these benefits are realised as soon as possible and maintained into the future.

As discussed, single-use EPS food and beverage containers are not commonly recycled, and therefore, at end-of-life, most are either incinerated for energy (releasing carbon dioxide emissions) or sent to landfill where they do not degrade.²⁰ In addition, some single-use EPS containers are disposed of incorrectly as litter²¹ which costs public money to clean up²² and imposes other costs on society including visual pollution and environmental harm. Littered EPS food and beverage containers also pose a risk to wildlife – either in their full form or when broken into smaller particles, including microplastics – they can easily entangle or be ingested by aquatic life if they enter the water system and/or marine environment. Microplastics transfer up the food chain and studies are beginning to identify the harm they can cause humans.^{23 24 25}

EPS food and beverage containers are estimated to make up 1.80% of all beach litter²⁶. These items are being targeted for a ban as opposed to other beach litter items because they are one of the most prevalent plastics in freshwater environments²⁷ and clear, readily available alternative material substitutes exist. These substitutes are paper equivalents for single-use, or reusable options.²⁸ Alternative materials decompose quicker – in terrestrial environments, paper is estimated to decompose in 4 to 6 weeks²⁹. This faster decomposition of alternative materials means a ban on single-use EPS items will reduce the risk of harm to animal life and lead to amenity benefits resulting from cleaner beach and terrestrial environments and reduced coastal clean-up costs to LA's. Items made from paper are less carbon intensive to manufacture and incinerate than plastic, causing less environmental damage in terms of greenhouse gas emissions.^{30 31}

Market data³² show that the share of food and beverage containers made from EPS has been declining over time. A major voluntary approach to reducing plastics is occurring through the UK Plastics Pact. Pact members account for approximately two-thirds of the consumer packaging used

20 Ellen MacArthur Foundation (2017) [The New Plastics Economy: Rethinking the Future of Plastics and Catalysing Action](#)

21 WRAP (2022) [Eliminating Problem Plastics](#)

22 Government Office for Science [Foresight Future of the Sea](#)

23 Fleury, J.B. and Baulin V.A (2021) 'Microplastics destabilise lipid membranes by mechanical stretching'.

24 Goodman et al, [2021 Exposure of Human Lung Cells to Polystyrene Microplastics Significantly Retards Cell Proliferation and Triggers Morphological Changes](#)

25 UNEP (2018) Single-use plastics – A roadmap to sustainability

26 Resource futures (2018) [A preliminary assessment of the economic impacts of a potential ban on expanded polystyrene food and beverage containers](#)

27

City to Sea [The most polluting single use plastic items](#)

28 Resource futures (2018) [A preliminary assessment of the economic impacts of a potential ban on expanded polystyrene food and beverage containers](#)

29 Resource futures (2018) [A preliminary assessment of the economic impacts of a potential ban on expanded polystyrene food and beverage containers](#)

30 A tonne of wood and paper release approximately 233 kgCO₂e and 354 kgCO₂e per tonne of material used during production, whereas comparative values for polypropylene and polystyrene measure at 1875 kgCO₂e and 2306 kgCO₂e per tonne, WRAP data

31 Paper releases carbon emissions when landfilled, although the carbon savings of paper (as opposed to plastic) production and incineration outweigh the costs of the landfill emissions. These costs and benefits are shown in Table 1.

32 Valpak (unpublished), 2022

in the UK. The UK Plastics Pact 2020-21 Annual Report showed that members had achieved a 46% reduction since 2018 in the plastic items they were targeting for elimination, which demonstrates the impact a voluntary approach can have. However, while Plastics Pact members are targeting the elimination of household polystyrene packaging, they are not specifically aiming to eliminate the polystyrene items targeted by this policy. Additionally, there will be many businesses that aren't Plastics Pact members and aren't seeking to reduce their use of single-use plastics outside the Plastics Pact either.

Market data shows a decreasing rate of decline in the market share of EPS items. It is estimated (using this data) that single-use food and beverage containers made from EPS will represent 5% of the market in 2023 when the ban is enacted and in the absence of a ban will plateau at this rate throughout the appraisal period.³³ Therefore, Government intervention, rather than reliance on voluntary action, is required to stem the flow of single-use EPS food and beverage containers faster and more widely. Intervention will correct the market failure arising from the multiple negative externalities and to reduce England's harmful and unnecessary plastic pollution. This ensuring that the environmental and social benefits of addressing these externalities are maximised and maintained into the future.

When considering alternative options such as information and education, request only options, subsidies, and taxation and charges, we have drawn on Defra's previous work on single-use plastic items. Alternative options, both regulatory and non-regulatory, were ruled out in favour of a ban, in order to maximise the environmental and social benefits from reduced EPS food and beverage containers consumption and ensure these benefits are realised as soon as possible. A ban allows for a maximum reduction in pollution for the minimum cost to business and society. Due to evidence indicating the harmful effects these single-use plastics have on animals, humans, and the environment and also the scientific uncertainty about the extent of the lifetimes of these single use plastics we are adopting the precautionary principle and thus a ban is the preferred option.

Policy Objective

In the 25 Year Environment Plan,³⁴ the Government set out its ambition to help protect our environment for future generations, improve environmental quality, and reduce harm to human health and marine life.

It gives a clear direction related to plastics:

- 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.

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.³⁵ In the Environmental Improvement Plan 2023, the first revision of the 25 Year Environment Plan, we set an interim target, which will allow us to track our progress against the 2042 commitment. By 31 January 2028, we will reduce residual municipal plastic waste produced by person by 45%. This is equivalent to a 45% reduction from 2019 levels.

To help meet this ambition, the Government intends to ban the most harmful plastic products where there is a clear case for it and alternatives exist. Bans on the manufacture and sale of rinse-off

³³ Valpak (unpublished), 2022 and Defra assumptions.

³⁴ [A Green Future: Our 25 Year Plan to Improve the Environment](#)

³⁵ [Our Waste, Our Resources: A Strategy for England](#)

personal care products containing plastic microbeads are already in place.³⁶ Restrictions on the supply to the end user of single-use plastic drinking straws and single-use plastic-stemmed cotton buds and a prohibition on the supply of plastic drinks stirrers came into force in October 2020.³⁷

Some organisations have already made strides to reduce their single-use plastic usage. For example, the NHS delisted plastic straws and stirrers ahead of the pledged date and are now focusing on phasing out single-use plastic cutlery and plates and single-use cups made of expanded polystyrene and oxo-degradable plastics.³⁸ Furthermore, as of January 2020, IKEA have removed all single-use plastic products, including plates and cutlery.³⁹ 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.⁴⁰

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 enacting bans on the supply of single-use plastic balloon sticks and cutlery and a ban on the supply to the end user of single-use plastic plates, bowls, and trays when not used as packaging.

Plastic packaging waste accounts for nearly half of all plastic waste generated in the UK.⁴¹ The plastic packaging tax⁴² and our proposals to reform the packaging waste regulations 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 the public recycle more and increase the amount of plastic that is collected and made available for recycling. Additionally, introducing a Deposit Return Scheme⁴³ 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.

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.⁴⁴

Changes made to this Impact Assessment following the consultation

- The implementation date for the ban has been changed from April 2023 to October 2023. This later implementation date has slightly reduced the benefits and some costs of the policy during the appraisal period.
- We have improved the rationale for policy intervention to clarify the specific problems being addressed and why Government intervention is necessary to rectify these issues.

³⁶ [The Environmental Protection \(Microbeads\) \(England\) Regulations 2017 \(legislation.gov.uk\)](#)

³⁷ [Straws, cotton buds and drink stirrers ban: rules for businesses in England](#)

³⁸ <https://www.supplychain.nhs.uk/news-article/supporting-pledge-to-reduce-plastic-waste-in-hospital-canteens/>

³⁹ <https://about.ikea.com/en/sustainability/healthy-and-sustainable-living/eliminating-single-use-plastics>

⁴⁰ Adeyanju, G.C., Augustine, T.M., Volkmann, S. *et al.* (2021) [Effectiveness of intervention on behaviour change against use of non-biodegradable plastic bags: a systematic review](#). *Discov Sustain* **2**, 13. See for similar rationale in regard to plastic bags

⁴¹ WRAP (2019) [Plastics Market Situation report 2019](#)

⁴² <https://www.gov.uk/guidance/check-if-you-need-to-register-for-plastic-packaging-tax>

⁴³ [Introduction of a deposit return scheme in England, Wales and Northern Ireland - GOV.UK \(www.gov.uk\)](#)

⁴⁴ Adeyanju, G.C., Augustine, T.M., Volkmann, S. *et al.* (2021) [Effectiveness of intervention on behaviour change against use of non-biodegradable plastic bags: a systematic review](#). *Discov Sustain* **2**, 13 see for similar rationale in regard to plastic bags

- We have redrafted the options section to justify why alternative options were not analysed at consultation stage, and why these options, alongside the current market-based approach and voluntary action, would not be sufficient.
- We have strengthened our consumption estimates of single use food and beverage containers in England, based on recent market data Valpak compiled for Defra, which has reduced them from 1.4 billion items annually to 0.68 billion⁴⁵.
- Previously we assumed EPS made up 80% of all food and beverage containers in 2018. Since consultation, we strengthened the evidence behind the counterfactual. Valpak compiled market data for Defra which has informed our assumption of EPS being 10% of all food and beverage containers consumed in 2020. The market data has informed updated assumptions around decreasing market share under a no ban scenario (dropping to 5% when the ban is enacted in 2023), as detailed in our counterfactual section.

For the consumption and market share assumptions, we can have far more confidence in the estimates provided by Valpak, compared to the estimates used at consultation stage. The consultation stage estimates relied on data and assumptions from interviewed stakeholders, as market research reports did not contain granular product level data⁴⁶. In contrast, Valpak have provided comprehensive estimates using their Environmental Product Information Centre (EPIC) database.

- At consultation we used unit cost estimates informed by Resource Future’s 2018 report.⁴⁷ Resource Futures’ estimates were based on online research from two websites, accessed in 2018, and stakeholder interviews. We have updated these cost estimates via desk-based research, using more recent data from a wider range of sources⁴⁸, to improve accuracy.

Unit cost estimates	Consultation stage	Final stage
Average EPS food and beverage container	£0.03	£0.05
Average paper food and beverage container	£0.08	£0.15

The lower consumption and market share estimates have lowered the alternative material costs from £306.4m at consultation to £33.7m, across the 10-year appraisal period.

Additionally, we have also changed the following:

- Familiarisation costs have only been monetised once across the bans on EPS food and beverage containers and single-use plastic plates and cutlery to avoid double counting. They are included as a monetised cost in this IA and as a non-monetised cost in the plates and cutlery IA.
- The benefit of reduced litter in terrestrial settings has now been monetised.
- We have strengthened the end-of-life assumptions by considering non-household municipal waste treatment data to more accurately weight the proportions of single-use plastic waste

⁴⁵ Valpak Single use plastic placed on the market report for Defra (unpublished), 2022

⁴⁶ Resource futures (2018) [A preliminary assessment of the economic impacts of a potential ban on expanded polystyrene food and beverage containers](#)

⁴⁷ Resource futures (2018) [A preliminary assessment of the economic impacts of a potential ban on expanded polystyrene food and beverage containers](#)

⁴⁸ Defra research based on a sample of products for sale from: Restaurant Supply Store, Kite Packaging, RR Packaging, Midpac, GreenFeel, The Party Experts, Onbuy, Cater 4 You, Amazon, Catering 24. Websites access in December 2021.

that ends up in landfill vs incineration. We have also amended the proportion of paper items that get recycled from 0% to 10%, based on Resource Futures evidence.

- We now assume a reactive method of enforcement.
- We have strengthened our analysis on producer impacts. This has involved adding a new monetised cost: the direct impact of profit loss for producers as a result of no longer producing EPS food and beverage containers. We have also reduced the central capital investment cost estimate from £120 million to £60 million⁴⁹, based on consultation responses and further engagement with industry. Further details can be found in our Producer Impacts section.
- We have added an assessment on competition, trade and innovation and strengthened the equalities assessment using analysis of the consultation responses.
- We have strengthened the SaMBA, modelling scenarios of EPS use by small and micro businesses and taking into account impacts on producers. We have also added an assessment on medium businesses.

Overall, the NPV has increased from -£332.4m at consultation stage to -£76.7m and the Equivalent Annual Net Direct Cost to Business (EANDCB) has decreased from £43.1m to £10.2m (2019 prices, 2020 PV).

Options Under Consideration

The cost benefit assessment considers two options: the 'do-nothing' option and the option **to ban the supply of single-use EPS food and beverage containers in October 2023**. The latter is the 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 considered several alternative policy options. These have not been appraised as they would not eliminate these single-use plastic items at the same speed or scale as the proposed ban. Other interventions would not create a level playing field and would not strengthen the market to innovate – this was highlighted in stakeholder discussions that were undertaken by Resource Futures.⁵⁰ Furthermore, a ban on the supply of single-use EPS food and beverage containers will align with legislation on other single-use plastic items such as straws and stirrers.

Non-appraised 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 restriction on supply. Some businesses are voluntarily moving away from single-use EPS items; this is factored into the do-nothing scenario.

Although there is currently a concerted voluntary reduction in single-use EPS 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, for example, if current media and public attention on the issue does not persist. This means the environmental costs

⁴⁹ Unadjusted for inflation.

⁵⁰ Resource futures (2018) [A preliminary assessment of the economic impacts of a potential ban on expanded polystyrene food and beverage containers](#)

associated with single-use EPS food and beverage containers, 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 EPS food and beverage containers, active from October 2023 (preferred)

This is the preferred option.

As described in the rationale for intervention section, single-use food and beverage containers made from expanded or extruded polystyrene impose environmental and social costs; a ban on supply will reduce these costs significantly. This choice of intervention applies the precautionary principle and will secure the change and associated environmental benefits quickly and ensure that these are sustained into the future.

Businesses will have to source food and beverage containers from non-plastic materials. This is expected to incur some costs, but a proportion of these will be mitigated by the current trend in the market to move away from single-use plastic items and the increasing availability of non-plastic alternatives. There will also be familiarisation costs to business in advance of the change in legislation.

The ban will foster an increased degree of consumer confidence that the products they use will not harm wildlife and the environment. It will also increase consumer awareness of the environmental harms single-use plastic 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, plastic litter was reduced by 59% to 89%, depending on locations.⁵¹

No exemptions are currently proposed under this ban as, unlike straws, no concerns were raised by any group of the public has an absolute requirement for single-use food and beverage containers made from EPS rather than from plastic-free alternatives (e.g., for medical use). We tested this hypothesis in the consultation. While the majority of respondents did not suggest the need for exemptions (80%), a number of suggestions for exemptions were put forward.

Respondents suggested the need for possible exemptions in healthcare settings, educational establishments, and prisons. However, many of the respondents were offering potential avenues for consideration rather than providing a specific example, or examples, based on relevant experience. Based on a combination of responses from the relevant organisations and post-consultation engagement, we were able to determine that no exemptions were needed in any of these settings.

Consultation support for a ban: The public consultation⁵² showed significant support for a ban on the supply of single-use EPS food and beverage containers, at 93% for each proposed type of item. Members of the public, respondents from NGOs and respondents from public bodies were the most supportive of the bans on these single-use items (95% for each group). Respondents from the manufacturing industry were least supportive of the policy proposals, with 72% supporting the ban on single-use EPS food and beverage containers.

⁵¹ [Do Plastic Bag Bans Work? - Scientific American](#)

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

⁵² [Consultation, Banning the supply of commonly littered single use plastic items](#)

Non-appraised options

In the 25 Year Environment Plan, and reiterated in the Resources and Waste Strategy, we committed to eliminating all avoidable plastic waste throughout the lifetime of the plan. The impact plastic pollution has on our environment is well documented, and urgent action is required to stem the flow of these materials into the natural world. The Resources and Waste 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. 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 – the EU, for example, introduced a number of product bans through Article 5 of Directive (EU) 2019/904, which had a transposition deadline of July 2021, including on EPS food and beverage containers.⁵³ The Scottish Government have already introduced a ban on the supply and manufacture of various single-use plastic items, including EPS food and beverage containers.⁵⁴ ⁵⁵ The Senedd has approved legislation to ban the supply of various single-use plastic items in Wales, which will take effect in autumn 2023.⁵⁶

The following options have been explored but not fully appraised as work conducted in the development of similar past legislation (such as the ban on single-use plastic straws, buds and stirrers⁵⁷) has found that these would not reduce the impacts to the environment with 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 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 impact of further information on top of these campaigns is likely to be minimal and so may not be cost effective. Interventions to increase consumer awareness may succeed in improving people’s knowledge about the negative environmental consequences of certain actions, but this knowledge will not gain motivational force if protecting the environment is not an important personal value.⁵⁸
- **Request only option** – single-use EPS food and beverage 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. It would also be more difficult for enforcement bodies to monitor.
- **Subsidies** – towards the development of alternative material products are not considered necessary. Substitutes already exist and are widely used.
- **A taxation or charge policy** – although this would likely be effective in reducing consumption and could account for the social and environmental cost of EPS usage in market prices, it would not be as effective as a ban since the items would still be in circulation and being littered. Another risk with a tax or charge instead of a ban is that effectiveness has been found to

⁵³ European Commission, [Single-use plastics](#)

⁵⁴ <https://www.legislation.gov.uk/ssi/2019/271/made>

⁵⁵ <https://www.legislation.gov.uk/ssi/2021/410/contents/made>

⁵⁶ [Wales at the forefront of UK action as Senedd says no to single-use plastics | GOV.WALES](#)

⁵⁷ <https://www.gov.uk/government/news/start-of-ban-on-plastic-straws-stirrers-and-cotton-buds>

⁵⁸ Bolderdijk JW, Gorsira M, Keizer K, Steg L (2013) [Values Determine the \(In\)Effectiveness of Informational Interventions in Promoting Pro-Environmental Behavior](#).

reduce 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.⁵⁹ A ban avoids this risk and ensures that the desired impact is sustained.

Summary of Impacts and NPVs – Preferred Option

Table 1 below gives a summary of the monetised costs, 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’ scenario). 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 help investigate the significance of key assumptions used in the analysis.

The central NPV estimate is -£90.2 million (2020 prices, 2023 present value). The largest benefit is the beach wellbeing benefit. The largest overall cost to businesses arises from investing in new production capital if producers decide to produce alternative material items.

Table 1: 10-Year NPV estimates for ban on single-use EPS food and beverage containers, (2020 prices, 2023 present value base year, millions)

		Low (worst case)	Central	High (best case)
Benefits	Production emission savings to society	£0.3	£0.4	£0.4
	Disposal incineration emission benefit to society	£0.6	£0.8	£1.0
	Reduced coastal clean-up costs to LAs	£0.4	£0.5	£0.6
	Beach well-being benefit to society	£6.5	£12.3	£20.0
	Reduced terrestrial litter benefit to society	£0.2	£0.5	£0.9
Costs	Disposal landfill emission cost to society	£0.3	£0.2	£0.2
	One-off capital investment cost to businesses	£130.1	£65.0	£32.5
	Additional waste management costs to businesses	£0.0	£0.0	£0.0
	Additional waste management costs to LAs	£0.3	£0.3	£0.2
	Alternative material (paper) price costs to businesses	£42.2	£33.7	£25.3
	Producer profit loss	£3.0	£2.4	£1.8

⁵⁹ [Institute for European Environmental Policy](#)

	Familiarisation costs to businesses	£1.3	£1.1	£0.4
	Fuel costs to businesses	£2.2	£1.2	£0.4
	Fuel emission costs to society	£0.8	£0.4	£0.2
	Enforcement costs to LAs	£0.3	£0.3	£0.3
	Total	-£172.6	-£90.2	-£38.4

*Note: some figures may appear to be 0 due to rounding

LAs: Local authorities.

Further detail on Table 1 can be found in the benefits and costs sections below. All NPV figures are in 2020 prices, unless stated otherwise. This was chosen as the standard price base year for consistency with the consultation stage IA.

Although the final NPV is negative, the ban remains the preferred option due to the non-monetised factors excluded from the NPV estimates. A key benefit which has not been monetised is the reduction in harm to natural environments and resulting societal benefits. We found this to be unquantifiable, with a recent UN report restating the challenge in quantifying this benefit due to insufficient available research on these impacts.⁶⁰ Although it has not been possible to monetise all these benefits, they are analysed in detail as non-monetised benefits below. Another consideration is that the monetised costs may fall significantly if the prices of paper food and beverage containers decrease, which is possible due to economies of scale as the scale of production increases.

Key Assumptions and Methodology

Low/Central/High Scenarios

We have modelled three scenarios to account for uncertainties related to the cost assumptions, the number of single-use EPS food and beverage containers consumed in England and the market share of items from alternative materials.

The low NPV scenario (worst case) uses the low estimate for the total number of single-use EPS food and beverage containers used. 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 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 takes to decompose.
- the amount of time it takes businesses to familiarise themselves with the ban.
- the proportion of items that end up on beaches and streets as litter.
- and differing values in the literature placed on having cleaner beaches and streets.

Single-use food and beverage containers

Market data⁶¹ shows that 679,300,499 disposable food and beverage containers were placed on the market in England between 2019 and 2020. To account for any shocks in use from Covid-19, we take the average number of items placed on the market in 2019 and 2020 as our central estimate. Table

⁶⁰ UNEP (2021) 'From pollution to solution: A global assessment of marine litter and plastic pollution'

⁶¹ Valpak (unpublished), 2022

2 illustrates the low and high estimates, assuming consumption to be 75% and 125% of the central estimate.

Table 2: Single-use food and beverage container consumption in England, in billions

	Food and beverage containers
Low	0.51
Central	0.68
High	0.85

Counterfactual

We have used sales data provided by Valpak (in a project for Defra carried out post-consultation)⁶² to explore current trends in the single-use food and beverage containers market.⁶³ We assess the costs and benefits of the preferred option against the absence of the ban (i.e., in the ‘do nothing’ scenario). We have estimated in the central NPV scenario that 0.68 billion single-use food and beverage containers are consumed in England each year – most of which are already made from alternative materials such as paper.

One challenge with the analysis is a trend to move away from single-use plastic products. This dynamic trend makes it difficult to be certain about what the market would do if no ban on these items was imposed. A significant number of businesses have already voluntarily switched to alternative material products, meaning a large proportion of the market is likely to already be non-plastic. We have selected paper as the alternative material for single-use food and beverage containers, as this is the most prevalent alternative material in the current market. However, as technology develops, it is possible that another material, or materials, will become the dominant alternative.

Valpak market data⁶⁴ shows that EPS food and beverage containers represented 10% of all single-use food and beverage containers consumed in 2020. Market data⁶⁵ shows that the share of food and beverage containers made from EPS has been declining over time. We have extrapolated this market data trend to project a further 2.5% drop in market share in 2021 and 2022, with EPS market share reaching 5% in 2022.

In the absence of a ban, some residual use of EPS food and beverage containers is expected to remain, with a small proportion of businesses continuing to use these items due to their lower cost, perceived benefit to consumers, or inertia in business purchasing decisions. This residual use in the absence of a ban was raised through multiple responses to our consultation and was flagged during Valpak’s industry engagement as part of the market data project.

Residual use of the items in the absence of a ban results in a plateauing market share in the no ban scenario. We have modelled the counterfactual market share for EPS food and beverage containers to plateau at 5% in 2022, staying at this level throughout the remainder of the appraisal period. 5% was judged to be the most appropriate estimate of the level at which the market share would plateau, considering industry views, market size and market structure (noting that the majority of current EPS

⁶² Valpak (unpublished), 2022

⁶³ The forecasted trend is used 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 speculative, and there is no guarantee that, in the absence of a ban, single-use EPS food and beverage containers usage will decrease by as much as predicted or would not rise again in the future. For example, if current public awareness and media attention on the issue is not sustained.

⁶⁴ Valpak (unpublished), 2022

⁶⁵ Valpak (unpublished), 2022

use is likely to be by small and micro businesses⁶⁶, who may be less inclined to switch in the absence of a ban).

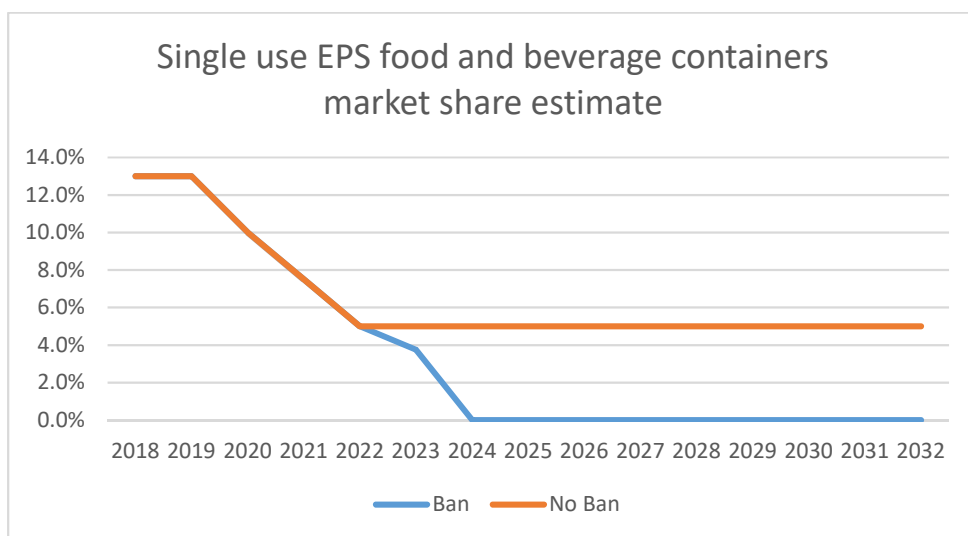
The extrapolated market data resulted in a 5% EPS market share in 2022, therefore 2022 was modelled as the start of the plateauing market share.

EPS containers and single-use plastic cutlery market shares have been judged to have the same plateau level (5%) in a no ban scenario (see separate IA covering ban on single-use plastic plates and cutlery). Many of the end users of these items (e.g., takeaway shops) will provide demand for both items. Therefore, it follows that that a similar proportion of the market would continue to choose both single-use plastic items (EPS and cutlery) once others had switched to environmentally preferred alternatives, due to their lower cost – which is likely to be maintained. Single-use plastic cutlery is often part of a wider portfolio for producers/importers; therefore, these items may still be able to compete on price following declining demand, with fixed costs split over a wider product range. Though EPS production is more specialised, EPS items currently have a larger price difference compared to paper alternatives and would be likely to still compete on price, even if declining demand reduced economies of scale and increased production costs per item.

The EPS counterfactual has been tested with an industry expert from the British Plastics Federation, who agrees the market share assumptions are reasonable. British Plastics Federation members have not been consulted on these assumptions.

The modelled **no ban scenario** is compared to the **ban scenario** in Figure 1 below:

Figure 1: Scenario estimates of EPS food and beverage containers share out of all single-use food and beverage containers⁶⁷



Source: Valpak data and Defra modelling

Market share estimates for the counterfactual chart above are calculated for whole calendar years. In 2023, the ban will be in place for 3 out of 12 months. Therefore, the 2023 market share for the ban scenario is calculated as: (9 months * 5% market share) + (3 months * 0% market share) = 3.8%.

⁶⁶ Larger businesses are more likely to have already shifted away from these items than smaller businesses, confirmed through our engagement with UK Hospitality.

⁶⁷ Modelled no ban scenario assumes a shift from the 10% share of EPS for disposable food and beverage containers in 2020 to a final base share of 5%, with the share reducing by 2.5 percentage points each year.

Total product sales (both EPS and non-plastic single-use products) are assumed to increase in line with population growth (3%) each year under both the ban and no ban scenarios.

For cost and benefit calculations which include the total food and beverage container consumption figure, the impact of the ban is calculated using the difference in market share of the banned items between the ban and no ban scenario. This is also adjusted to account for total market growth (in line with population). This results in the following profile of market shares applied to these calculations:

Table 3: Profile of market shares, central scenario⁶⁸

2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
1.37%	5.63%	5.80%	5.97%	6.15%	6.33%	6.52%	6.72%	6.92%	7.13%

Our methodology assumes that consumption of the banned single-use plastic items will be entirely replaced by consumption of alternative material single-use items. The ban may also encourage increased use of re-usable alternatives to the single-use plastic items, which if re-used enough times are likely to bring greater environmental benefits. There may be a small risk of re-usable alternatives being consumed as single-use items, though this is considered unlikely due to their higher price and the availability of plastic-free single-use items.

End of life assumptions

At end of life, disposal and recycling behaviours determine the environmental impacts associated with resource recovery and waste management. Based on the Resource Futures research⁶⁹, local authority outturn data⁷⁰ and Defra modelling of non-household municipal waste treatment⁷¹, it is assumed that the items will be disposed of in the following way:

Table 4: EPS end of life breakdown by material

	Plastic	Paper
Recycled	0.0%	10.0%
Incinerated	80.7%	72.6%
Landfill	18.8%	16.9%
Commercial composting	0.0%	0.0%
Terrestrial litter	0.5%	0.5%
Beach litter	0.0005%	0.000005%

⁶⁸ These percentages are the difference in consumption of EPS containers between the ban and no ban scenario, relative to the 0.68 billion 2020 consumption estimate for all single-use food and beverage containers. For example, in 2025 EPS consumption in the ban scenario is (5.8% * 0.68 billion) lower than in the no ban scenario and this is used to calculate the impact of the ban. These percentages growing beyond the 5% difference shown in the Figure 1 reflects the growth of the market as a whole.

⁶⁹ Resource futures (2018) [A preliminary assessment of the economic impacts of a potential ban on expanded polystyrene food and beverage containers](#)

⁷⁰ Defra (2022) <https://www.gov.uk/government/statistical-data-sets/env18-local-authority-collected-waste-annual-results-tables>

⁷¹ Internal Defra modelling estimates that 64% of non-household municipal residual waste is sent to landfill.

Based on internal advice and owing to the takeaway nature of these items, it is assumed 90% of the waste from these items is managed by local authorities, with the remaining 10% managed by businesses⁷². We have applied this weighting to the local authority outturn data and Defra modelling of non-household municipal waste treatment data, to estimate the proportion of these items sent to landfill vs incineration. Including non-household municipal waste treatment data within the calculation has increased the proportion of this waste assumed to be landfilled, compared to at consultation stage.

Litter composition assumptions

These litter composition estimates are based on the Resource Futures research⁷³. They are used in beach and terrestrial litter benefit calculations.

Table 5: Assumed composition of EPS food and beverage containers in terrestrial and beach litter

	Terrestrial	Beach
Boxes	0.14%	0.24%
Cups	0.43%	0.74%
Trays and cones	0.43%	0.74%
Pots	0.05%	0.09%
Total	1.05%	1.80%

Summary of Monetised Costs

Familiarisation costs

Familiarisation costs are the one-off costs that businesses face upon implementation of the ban. For retailers, this will cover the time taken to inform employees about the ban, costs attached to any necessary price changes of products, and time taken to shop around for an alternative supplier.⁷⁴ Wholesalers and producers may face more complex business decisions following a ban. These are discussed further in the Producer impacts and Wholesaler impacts sections.

Our estimate is that 155,923 businesses⁷⁵ will be affected by familiarisation costs in total across the bans on single-use plastic plates and cutlery and EPS food and beverage containers. These include restaurants, takeaway vendors, event caterers, and a range of retailers including supermarkets - further detail on relevant SIC breakdown is included in table 6 below.

The 30 minute familiarisation time estimate (outlined below and supported through consultation) covers the time taken for a business to familiarise with both the ban on EPS and on plates and cutlery. The SIC codes in scope of the bans are identical, with the exception of one additional SIC code for EPS. Therefore, the EPS business numbers in scope estimate can be used to calculate the total

⁷² WRAP (2019) National Municipal Waste Composition study supports the assumption that the vast majority of municipal polystyrene residual waste is non-commercial https://wrap.org.uk/sites/default/files/2020-11/WRAP-National%20municipal%20waste%20composition_%20England%202017.pdf

⁷³ Resource futures (2018) [A preliminary assessment of the economic impacts of a potential ban on expanded polystyrene food and beverage containers](#)

⁷⁴ 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.

⁷⁵ Office for National Statistics, UK business: activity, size and location, 2020 and FSA Food Hygiene Rating Scheme

familiarisation cost across the bans. For simplicity, this cost has been allocated to the EPS IA calculations and is included as a non-monetised cost in the plates and cutlery IA.

Familiarisation costs should be minimised by the guidance on the set of bans which Defra has shared with key industry bodies in April 2023, available for them to share with their members.

Monetisation of familiarisation costs

We have monetised this cost using the following figures and assumptions:

- Categories of businesses likely to be affected by the ban were identified using Standard Industrialisation Codes (SIC)
 - o Data from the Food Hygiene Rating Scheme⁷⁶ was used to identify the proportion of businesses in each SIC category which may not be in scope of the ban. We apply the proportion for businesses exempt from reporting a food hygiene rating in the hospitality sector (due to not directly handling food)⁷⁷ to net out these businesses. Our estimate is that 155,923 businesses⁷⁸ will be affected by familiarisation costs in total. These include restaurants, takeaway vendors, event caterers, and a range of retailers including supermarkets - further detail on relevant SIC breakdown is included in the text below. We have made the assumption that the businesses in the SIC codes included will deal with single-use food and beverage containers, though not all will offer a takeaway service therefore the business number estimate is likely to be an overestimate.
- There is uncertainty around the number of businesses that have transitioned away from single-use EPS food and beverage containers voluntarily. Hence, we have precautionarily assumed that all identified businesses will experience the familiarisation cost.
- 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 45 minutes, respectively.⁷⁹ This was costed at the average hourly wage for each businesses category⁸⁰ plus 22% non-wage labour costs⁸¹. To account for the size of small and micro businesses in the sector, the Small and Micro Businesses Assessment below includes sensitivity analysis assuming that employees in such businesses may need more familiarisation time.

Table 6 calculates familiarisation costs in the central scenario by multiplying the number of enterprises for each SIC (155,923) by their respective median hourly wage (including 22% non-labour wage costs) and by the time burden required by one full time employee per business (30 min).

Table 6: Business familiarisation costs, England

SIC code	England business enterprises in scope	Hourly wage	Inc. 22% non-labour wage adjustment	Familiarisation costs	% exempt from FHRS (already included)
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⁷⁶ Food Standards Agency [Food Hygiene Rating Scheme](#)

⁷⁷ 1% of businesses in 'Restaurant and mobile food service activities', 5% of businesses in 'Hotels and similar accommodation' and 8% of businesses in 'Other catering premises', 13% of Retailers

⁷⁸ Office for National Statistics, UK business: activity, size and location, 2020 and FSA Food Hygiene Rating Scheme

⁷⁹ Respondents to the consultation were asked whether they agreed/disagreed/were unsure of 30 minutes familiarisation time. Only 10% disagreed, whilst 32% agreed and so we have kept the central estimate the same as at consultation stage.

⁸⁰ [Office for National Statistics](#) 'Earnings and hours worked', gross hourly pay 2021, revised.

⁸¹ [RPC short guidance note - Implementation costs August 2019.pdf \(publishing.service.gov.uk\)](#)

4711 : Retail sale in non-specialised stores with food; beverages or tobacco predominating	23,257	£10.48	£12.79	£148,676	13%
4729 : Other retail sale of food in specialised stores	3,231	£9.70	£11.83	£19,116	13%
4781 : Retail sale via stalls and markets of food; beverages and tobacco products	902	£8.05	£9.82	£4,430	13%
England Fast Food Restaurant Count ⁸² (instead of 5610 : Restaurants and mobile food service activities)	79,335	£8.91	£10.87	£646,792	1%
5621 : Event catering activities	10,796	£9.35	£11.41	£61,575	8%
5629 : Other food service activities	2,187	£9.46	£11.54	£12,621	8%
5630: Beverage activities	28,347	£8.46	£10.32	£146,288	8%
5510: Hotels and similar accommodation	7,868	£9.41	£11.48	£45,166	5%
Total	155,923			£1,084,663	

Since this cost is in 2021 prices, we then deflate it to 2020 as the standard price base year, before inputting this cost into the BIT calculator. This results in a present value cost of £1.1 m over the 10-year appraisal period, incurred in full in the first year of the bans.

Enforcement Costs

Enforcement costs relate to the estimated additional burden to the 150 Trading Standards Authorities (TSAs) offices across England⁸³ which will enforce the policy, using a reactive method.

As the ban will be enforced using a reactive method, compliant businesses will not face any enforcement-related costs. Non-compliant businesses will incur time related costs if they are inspected but these have not been monetised, as per RPC guidance.

The below assumptions and calculation of enforcement costs have been tested and agreed with the Association of Chief Trading Standards Officers.

Monetisation of enforcement costs

Because of the reactive enforcement approach targeting non-compliant businesses, we estimate that 0.25% of businesses in scope of the bans on EPS and single-use plastic plates and cutlery will be inspected. This reflects that many of the businesses in scope will have already shifted away from using the banned items. It is also based on the number of enforcement actions taken in the case of previous similar bans.

Engagement with the Association of Chief Trading Standards Officers (ACTSO) suggests that inspecting premises selling these items in the first instance will occupy 3.5 hours of an officer's time per year at a rate of £79.30 per hour.

⁸² DHSC (2018) [Fast Food Outlets Density by Local Authority in England](#) used instead of 5610 since restaurants are less likely to handle EPS food and beverage containers.

⁸³ 22 TSA in Wales <https://www.tradingstandards.wales.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>.

We assume a 25% non-compliance rate following the initial visit (informed by ACTSO). Engagement with ACTSO suggests that inspecting premises selling these items in the second instance will occupy 7 hours of an officer's time per year at a rate of £79.30 per hour. We estimate the annual cost of legal action associated with non-compliance in the second instance to be £41k for both the bans on EPS and single-use plastic plates and cutlery (informed by ACTSO).

We also include in these calculations the cost of non-chargeable advice provided to businesses. We assume that on average, for each local authority, this will occupy 7 hours of an officer's time per year at a rate of £79.30 per hour, for both EPS and single-use plastic plates and cutlery products. We multiply this by the 150 local authorities in England to get a cost of £83k for the bans on EPS/P&C.

We have used the ratio of number of businesses in scope for each ban to apportion the enforcement costs between the EPS IA (155,923 businesses) and plates and cutlery IA (127,576 businesses).

Since this cost is in 2023 prices, we then deflate it to 2020 as the standard price base year, before inputting this cost into the BIT calculator. For the EPS portion of the enforcement cost, this results in a present value cost of £0.3m over the 10-year appraisal period, incurred in the first three years of the policy.

Landfill Disposal Emissions Costs

Plastic-alternative products can result in environmental costs at the end of life. Paper items sent to landfill will emit more greenhouse gas emissions upon anaerobic decomposition than non-biodegradable plastic products. In our 'end-of-life' assumptions, we assume that a certain percentage of items are disposed of in landfill. The associated carbon emissions are reflected in the disposal landfill cost.

Monetisation of landfill disposal emissions cost

Table 4 (referenced earlier in the document) shows how single-use food and beverage containers are treated at end of life. The table is used to estimate the difference in CO₂e emissions caused by the landfill disposal of the plastic and alternative material products. Polystyrene emits 0.009 tonnes of CO₂e per tonne in landfill,⁸⁴ whereas paper emits 1.042 CO₂e per tonne.⁸⁵ The difference in emissions (56,854 tonnes over the ten-year appraisal period) is then multiplied by the central series carbon value in 2020 prices.⁸⁶ To calculate the landfill disposal emission costs caused by the ban we have then adjusted to account for market growth and the difference in market share of the banned items between the ban and no ban scenarios - see counterfactual section above. We then discount. This results in a present value cost of £0.2m over the 10-year appraisal period.

Material Costs

Material cost is the additional cost to economic agents as a result of switching from plastic to alternative materials. Defra desk research estimates that the average price of an EPS food and

84 WRAP (2021) [Carbon Waste and Resources Metric](#)

85 WRAP (2021) [Carbon Waste and Resources Metric](#)

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

beverage container is £0.05 per item, whereas paper alternatives cost on average £0.15 per item.⁸⁷ As per RPC guidance these costs are treated as direct costs to business in the EANDCB calculation.⁸⁸ Retailers who sell these items are expected to pass costs on to consumers in the higher prices charged. Hospitality businesses that choose to provide food and beverage containers free of charge alongside the purchase of food are expected to pass through these variable costs to consumers via general pricing structures, for example by slightly increasing the price of food. These indirect impacts have not been quantified at this stage as we do not have information on the price elasticity of single-use food and beverage containers. Sensitivity analysis apportioning the entire cost difference to consumers is presented at the end of this IA.

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. Taking this conservative approach acknowledges the potential for price increases as a result of supply shocks such as those experienced over recent years.

Monetisation of material costs

We estimate the total cost difference to all single-use food and beverage containers consumed by multiplying the unit price difference (£0.10) by the estimated volume of single use items consumed in England (0.68 bn – see Table 2). This gives us an annual estimate of £63m of cost difference, if all single-use food and beverage containers were EPS. To calculate the material costs caused by the ban we have then adjusted to account for market growth and the difference in market share of the banned items between the ban and no ban scenarios - see Table 3 in the counterfactual section above. This reduces the annual figure to reflect the costs imposed by the ban on EPS. Since this cost is in 2021 prices, we deflate it to 2020 prices as the standard price base year before inputting this cost into the BIT calculator. This results in a total present value cost over the 10-year appraisal period of £33.7m.

Fuel Costs

Resource Futures have estimated the average EPS food and beverage container weighs 4.5g while the average paper equivalent weighs 14.1g.⁸⁹ Additional weight requires more fuel to transport. A number of important factors are unknown, which makes it difficult to form a reliable estimate of fuel costs, such as:

- The average distance travelled by each plate in England.
- The number of plates 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 costs

⁸⁷ Defra research based on a sample of products for sale from: Meanwell Packaging, Cater4you, Catering24, Alliance Online, eBay, pfmplus, GM packaging, Amazon, Viking Direct, Zoro, Midpac, Drinkstuff, Paperstone, Restaurant Supply Store, Greenpak, Kite Packaging, Maddisons UK, Onbuy, [Accessed December 2021]

⁸⁸ Regulatory Policy Committee, [Business Impact Target specific issues: direct versus](#)

⁸⁹ Resource futures (2018) [A preliminary assessment of the economic impacts of a potential ban on expanded polystyrene food and beverage containers](#)

A study by the Massachusetts Institute of Technology found that if a light truck's weight load is reduced by 10kg, 80 litres of fuel are saved over 200,000km.⁹⁰ To adapt to this IA analysis, we assume fuel prices of £1.78/litre⁹¹. We assume the mean distance travelled by products to be 261km, based on responses received at consultation⁹². This implies that for every additional kg of weight transported a distance of 261km, additional fuel worth £0.19 is consumed. Due to the uncertainty surrounding a number of the inputs to this estimate, we have included this figure as the low scenario estimate and doubled it to provide a conservative central scenario estimate (£0.37). For the high scenario estimate, the estimated fuel costs have been tripled to reflect the uncertainty and to account for the extreme end of the scale (£0.56). Multiplying the average unit weight difference between EPS and paper food and beverage containers (10g) by the total EPS food and beverage container consumption (79 million) gives the total additional weight caused by the replacement of EPS with paper food and beverage containers. We then multiply the additional weight by the fuel cost difference over 261km⁹³. To calculate the fuel costs caused by the ban we have then adjusted to account for market growth and the difference in market share of the banned items between the ban and no ban scenarios - see counterfactual section above. Since this cost is in 2022 prices, we deflate it to 2020 prices as the standard price base year before inputting this cost into the BIT calculator. The present value of the cost over the appraisal period is £1.2m.

Fuel emissions costs

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

Monetisation of fuel emissions cost

Using an average of 2.42 kg CO₂e per litre of diesel burned,⁹⁴ an additional 21,000 litres of diesel will be required over the ten-year appraisal period in the central scenario due to 0.1 litres of additional fuel being required for every additional kg of weight transported 261km. This will result in 3.3 tonnes CO₂e in emissions. We use 2020 carbon prices and adjust to account for the expected shift away from single-use plastic items in our counterfactual. This results in a present value of £0.4m for fuel costs over the 10-year appraisal period. If trends continue to shift towards electric vehicles over the next decade this cost may be an overestimate of actual additional diesel costs arising from a shift to heavier weight items, however due to uncertainties we have opted for this method as the most proportionate.

Additional Waste Management Costs

As discussed in the fuel costs section above, single-use food and beverage containers made of paper weigh more than EPS equivalents. This will increase the waste management costs as landfill tax and landfill/incineration site gate fees are calculated by weight. Local authorities and businesses are expected to share the additional waste management cost burden. As outlined in 'End of life

⁹⁰ Government of Canada [Factors that Affect Fuel Efficiency](#)

⁹¹ BEIS, Monthly and annual prices of road fuels and petroleum products, Diesel price 2022.

⁹² The Foodservice Packaging Association's consultation response noted that 261km was the average distance travelled according to their members.

⁹³ The Foodservice Packaging Association's consultation response noted that 261km was the average distance travelled according to their members.

⁹⁴ BEIS, [Valuing greenhouse gas emissions in policy appraisal](#)

assumptions', we expect businesses and local authorities to manage 10% and 90% of the waste from these items respectively and therefore bear the same proportions of these costs.⁹⁵

Monetisation of additional waste management cost

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

- As presented in **Table 4**, 99.5% of single use EPS food and beverage containers and 89.5% of single use paper alternatives are sent for residual waste treatment (incineration or landfill) at the end of their lives
 - We estimate 72.6% of single-use EPS food and beverage containers are incinerated, while the remaining 16.9% are sent to landfill. These percentages are the same for the paper alternatives.

We estimate the cost of single-use EPS and paper food and beverage containers sent to waste treatment using 2020 rates of the landfill tax⁹⁶, landfill gate fee and incineration gate fee.⁹⁷ We then calculate the additional costs from moving to single-use paper rather than EPS items and apportion them between businesses and local authorities. To calculate the additional waste management costs caused by the ban we have then adjusted to account for market growth and the difference in market share of the banned items between the ban and no ban scenarios - see counterfactual section above. This results in a present value cost of £0.03m for businesses and £0.3m for Local Authorities over the 10-year appraisal period.

Only the cost to businesses has been included in the EANDCB.

Producer impacts

Evidence suggests that 95% of single-use EPS food and beverage containers are produced domestically, with the remaining 5% imported⁹⁸.

Following the implementation of the ban, producers will be forced to stop selling single-use EPS food and beverage containers in England and domestic producers are likely to stop production of these items entirely⁹⁹. The ban will have the direct impact of loss of profit from production of these items. This is monetised in the section below.

Following the ban, we would expect businesses to choose the course of action which maximises their profit function. Though there is potential that for some producers this may mean ceasing trading, we would also expect some producers to move to production of the next most profitable alternative for their business. We acknowledge any switch in production is likely to result in lower total profit, otherwise producers would have already made this switch. But it is reasonable to expect a proportion of the lost profit to be recouped through production of other items. This would be an indirect impact and is not considered within our EANDCB calculation.

Where producers switch to producing other items, there is likely to be some capital investment cost associated with making this switch. In an extreme scenario, all producers could choose to buy entirely new production capital, in order to produce the product types which are the subject of the

⁹⁵ Based on internal advice and owing to the takeaway nature of the items.

⁹⁶ HMRC, [Landfill Tax rates](#)

⁹⁷ Let's Recycle [EFW Landfill RDF 2020 rates](#)

⁹⁸ Resource futures (2018) [A preliminary assessment of the economic impacts of a potential ban on expanded polystyrene food and beverage containers](#)

⁹⁹ A Foodservice Packaging Association members survey on the impact of this set of bans (EPS, plates and cutlery and balloon sticks) indicated that no members intend to continue domestic production of the banned items.

ban using alternative materials, for example paper food and beverage containers. In a low-cost scenario, producers may be able to make more modest changes to their production processes, for example to pivot to produce other polystyrene items, which are not the subject of the ban. The reality is likely to fall between these two scenarios, with some existing production capital adjusted, some new production capital purchased and potentially some producers ceasing to trade. These investment decisions will also depend on the age and condition of existing capital assets. Fully depreciated capital assets, for example, may have led to significant capital investment anyway.

Monetisation of profit loss

We calculate annual wholesale revenue using an estimate of domestic sales for all single-use food and beverage containers multiplied by the average price wholesalers are selling the items at, which is £0.05. This gives an estimate of £35 million, for wholesale revenue generated by domestically produced single-use food and beverage containers.

2020 Annual Business Survey Data for SIC code 46 'wholesale trade, except of motor vehicles and motorcycles'¹⁰⁰ is used to calculate an estimate of wholesale markup. Turnover net of purchases of goods, materials and services is calculated as a proportion of turnover, giving an estimated wholesale markup of 15.8%. This estimate was sense checked and various sources¹⁰¹ indicated it to be a credible assumption. We then multiply wholesale revenue by the complement of wholesale markup to calculate an annual producer revenue estimate of £30 million.

Annual Business Survey Data for SIC code 22 'manufacture of rubber and plastic products'¹⁰² is used to calculate an estimate of producer profit margins. Turnover net of purchases of goods, materials and services and net of employment costs is calculated as a proportion of turnover, giving a producer profit margin of 16.2%. Multiplying producer revenue by the producer profit margins gives us an annual producer profit estimate of £4.8 million, for all food and beverage containers (EPS and other materials).

The initial totals above are calculated using the production estimate for all single-use food and beverage containers – only a small percentage of which are EPS items. To calculate the profit loss caused by the ban we have then adjusted to account for market growth and the difference in market share between the ban and no ban scenarios - see counterfactual section above. Since this cost is in 2021 prices, we deflate it to 2020 prices as the standard price base year before inputting this cost into the BIT calculator. This results in a present value cost of £2.4m over the appraisal period. To reflect the uncertainty in these calculations, we have used 75% and 125% of this central estimate for our lower and upper estimates.

Monetisation of capital investment costs

Currently, there are four manufacturing factories in the UK which produce single-use EPS food and beverage containers. Resource Futures estimate that the average capital costs associated with switching materials from EPS to paper would be £30m per manufacturing facility.¹⁰³ Defra's subsequent engagement with a producer of EPS provided an estimate of £10m - £30m. We have

¹⁰⁰ [Non-financial business economy, UK regional results: Sections A to S - Office for National Statistics](#)

¹⁰¹ PROs, [Distributor Markup and Profit Margins in the Supply Chain](#) and Chron, [The Average Profit Margin for Wholesale](#)

¹⁰² [Non-financial business economy, UK regional results: Sections A to S - Office for National Statistics](#)

¹⁰³ Resource futures (2018) [A preliminary assessment of the economic impacts of a potential ban on expanded polystyrene food and beverage containers](#)

taken the precautionary approach and kept £30m per manufacturing facility as our estimated cost of switching to paper container production.

In our high-cost scenario, all four manufacturers are assumed to invest £30m in production capital, to switch producing paper containers, giving a total cost of £120m. For our central scenario, we estimate the level of capital investment to be £60m, 50% of the high estimate. This assumes some producers will invest in new capital assets, some may adapt existing production processes at a lower cost, and some may cease trading entirely¹⁰⁴. For our low-cost scenario, we estimate the level of capital investment to be £30m, 25% of the high estimate. This assumes a higher proportion of producers will choose to cease trading or make more moderate adaptations to their production processes, with fewer choosing to invest in new assets to switch to alternative material production.

Since this cost is in 2018 prices, we inflate it to 2020 prices as the standard price base year before inputting this cost into the BIT calculator. This results in a central present value cost of £65.0m over the appraisal period, incurred in full in the first year of the ban.

Producer familiarisation costs

Producers of the banned items will also face familiarisation costs, from the time taken to read and understand the legislation and subsequently make business decisions relating to the ban. For some this could involve decisions relating to altering production processes or adjusting business plans. Therefore, we would expect familiarisation costs to be higher per business for producers than for other businesses, though they are likely to vary for each individual producer.

Familiarisation costs are likely to be minimised by single-use plastic bans having been in the public domain for a significant amount of time and therefore many businesses would have anticipated these bans. The Resources & Waste Strategy, published in 2018, set out potential bans. A ban on plastic straws, buds and stirrers was implemented in 2020, and this set of bans were consulted on in 2021. The government response announcing this set of bans has been published 9 months before implementation. Additionally, similar single-use items have been banned in other countries, such as Scotland. Responses to our consultation and to industry body surveys have suggested that many producers have already planned what they will do following a ban.

Familiarisation costs should be further reduced by the guidance on the set of bans which Defra has shared with key industry bodies in April 2023, available for them to share with their members.

These producer familiarisation costs will only apply to a very low number of businesses (currently four manufacturing facilities in the UK which produce single-use EPS food and beverage containers¹⁰⁵). Producers of other single-use plastic items would face no familiarisation costs, as it would be clear from the legislation that their products are not in scope.

Due to the very low number of businesses impacted it is not proportionate for producer familiarisation costs to be monetised in this impact assessment.

¹⁰⁴ A Foodservice Packaging Association members survey on the impact of this set of bans (EPS, plates and cutlery and balloon sticks), indicated that only one member intended to install new equipment to produce alternative material items, and confirmed that more moderate changes are more likely for most producers.

¹⁰⁵ Resource futures (2018) [A preliminary assessment of the economic impacts of a potential ban on expanded polystyrene food and beverage containers](#)

Summary of Monetised Benefits

Disposal Incineration Emissions Benefit

We assume that 80.7% of EPS and 72.6% of paper products are incinerated (Table 4). Paper items produce biogenic GHG emissions when incinerated, unlike EPS, which are cyclical in nature and are not included in carbon accounting. Once the energy generated is accounted for, paper food and beverage containers produce net emissions savings.

Monetisation of disposal incineration emissions benefit

To calculate the incineration benefit we estimate the difference in tonnes of CO₂e between emissions released upon incineration of the EPS product (1.691 tonnes CO₂e per tonne of material incinerated) and the emissions released upon incineration of the paper product (-0.218 CO₂e per tonne of material incinerated).¹⁰⁶ We then multiply the difference in emissions from incineration by the carbon value using 2020 carbon series.¹⁰⁷

To calculate the disposal incineration emissions benefit caused by the ban we have then adjusted to account for market growth and the difference in market share of the banned items between the ban and no ban scenarios - see counterfactual section above. We then discount. The benefit results in a present value of £0.8m over the appraisal period.

Beach Wellbeing Benefit

89% of people in the UK state that they are concerned about plastic pollution in the ocean.¹⁰⁸ The presence of litter can contribute to a fear of crime and injury, both of which have a negative wellbeing impact.¹⁰⁹ Litter can also discourage the use of public spaces and reduce our enjoyment of marine environments. There is a negative wellbeing impact experienced when harm to marine environments and the wildlife in them is observed. Clean environments have 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.

A ban on EPS food and beverage containers is expected to have a positive amenity benefit by reducing the amount of single-use plastic in circulation and potentially littered. Even if the alternative material items end up in marine environments, paper food and beverage containers will decompose much faster. This will lead to fewer of them being found across all environments as litter. As the alternative materials are derived from cellulose, they also pose less of a risk to wildlife if ingested and reduce the cumulative impact of microplastics in marine environments. An amenity benefit is generated from the satisfaction of knowing that something is being done to reduce harm to marine environments (beaches and seas) and monetised using a willingness-to-pay method.

Monetisation of beach wellbeing benefit

These impacts are difficult to monetise directly, so we have used a willingness to pay method.

106 WRAP (2021) [Carbon Waste and Resources Metric](#)

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

108 Populus (2018) Ocean Plastic Survey

109 Lorenc, T., Petticrew, M., Whitehead, M. *et al* (2013) [Fear of crime and the environment: systematic review of UK qualitative evidence. BMC Public Health 13, 496](#)

The Economics for the Environment Consultancy (Eftec)¹¹⁰ estimate that households' mean willingness to pay for clean beaches is £8.50¹¹¹ per year, based on a survey of 809 beach and non-beach users. Based on 23,274,000 households in England,¹¹² we estimate the total willingness to pay for clean beaches to be £197,829,000 per annum (central estimate). We assume that a small proportion of this estimate can be attributed to a reduction in littered single-use EPS food and beverage containers.

- Table 5 shows that the EPS items are estimated to make up 1.8% of all beach litter based on item volume¹¹³. We multiply this by the total willingness to pay for clean beaches to obtain an estimate for willingness to pay for beaches free of polystyrene litter. We then account for the difference in the decomposition rates between plastic and alternative material items. Our central estimate is that paper decomposes in 0.022% of the time it takes for polystyrene to decompose.¹¹⁴ We multiply the complement of this (99.98%) by the willingness to pay for beaches free of polystyrene litter. This is to reflect that paper food and beverage containers will be present in the marine environment for a significantly shorter period of time, leading to fewer items found.
- This gives us an estimate of the annual amenity benefit of marine litter reduction as a result of switching to alternative materials (£3.6m), based on EPS market share at the time of the litter figures (2018).¹¹⁵
- To calculate the impact of the ban, we then adjust using the difference in the market share between the ban and no ban scenario, relative to the 2018 market share.
- Since this cost is in 2002 prices, we inflate it to 2020 prices as the standard price base year before inputting this cost into the BIT calculator.

Over the 10-year appraisal period, the beach well-being benefit results in a present value of £12.3m.

Reduced terrestrial litter benefit

As mentioned above, a ban on single-use EPS food and beverage containers is expected to have a positive amenity benefit by reducing the amount of single-use plastic in circulation and potentially littered. While a ban won't reduce instances of littering, the alternative material items decompose much faster which will lead to fewer of them being found across all environments as litter. In addition to being visually unpleasant, it has been found to be the case that higher amounts of litter in an area are correlated with higher rates of crime in that same area, as suggested by the Broken Windows Theory.¹¹⁶ An amenity benefit is generated from the satisfaction of having cleaner streets in local authority areas.

Monetisation of reduced terrestrial litter benefit

These impacts are difficult to monetise directly, so we have used a willingness to pay method:

110 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](#)

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

112 ONS (2020) [Families and households](#)

113 Based on KBT (2014) study for England – litter composition minus chewing gum staining

114 Chamas et al (2020) Plastic: [Degradation Rates of Plastics in the Environment](#).

Paper: [Nagamine, R., Kobayashi, K., Kusumi, R. et al. \(2022\) Cellulose fiber biodegradation in natural waters: river water, brackish water, and seawater](#). Polystyrene takes 8,500 years to decompose in marine environments whereas paper takes 1.88 years to decompose in marine environments.

115 We have not modelled beach wellbeing benefits for the first 1.88 years of the policy due to the paper alternatives taking 1.88 years to decompose. This approach is in line with previous single-use plastic ban IA's, such as the straws ban.

116 Eunomia (2014) [Exploring the Indirect Costs of Litter in England](#)

- The Economics for the Environment Consultancy (Eftec)¹¹⁷ estimate that households' mean marginal willingness to pay for a 1% point reduction in Local Authority area litter is £0.66 per year (2020 prices). Based on there being 23,274,000 households in England¹¹⁸, we estimate that the total willingness to pay for a clean terrestrial environment is £15,360,840 per annum (central estimate) based on a 1% point improvement. We assume that a small proportion of this estimate can be attributed to a reduction in littered food and beverage containers.
- Single-use EPS food and beverage containers are estimated to make up 1.05% of all terrestrial litter¹¹⁹ based on item volume (as shown in table 5). We multiply this by the total willingness to pay for a clean terrestrial environment to obtain an estimate for willingness to pay for a terrestrial environment free of polystyrene litter. We then account for the difference in the decomposition rates between plastic and alternative material items. Our central estimate is that paper decomposes in 0.001% of the time it takes for polystyrene to decompose, in a land environment.¹²⁰ We multiply the complement of this (99.999%) by the willingness to pay for beaches free of polystyrene litter. This is to reflect that paper food and beverage containers will be present in the environment for a significantly shorter period of time, leading to fewer items found.
- This gives us an estimate of the annual terrestrial litter benefit as a result of using alternative materials (0.2m), based on EPS market share at the time of the litter figures (2018).¹²¹
- To calculate the impact of the ban, we then adjust using the difference in the market share between the ban and no ban scenario, relative to the 2018 market share.

Over the 10-year appraisal period, the reduced terrestrial litter benefit amounts to £0.5m in present value.

This estimate is much lower than the beach well-being benefit. The terrestrial litter estimate is encompassing of litter in all terrestrial locations, not solely populated streets. Additionally, marine litter is associated with harm to marine life, which may explain the higher willingness to pay for clean beaches.

Reduced Coastal Clean-Up Costs

The implementation of the ban on single-use EPS food and beverage containers is predicted to reduce marine litter clean-up costs to local authorities. The faster decomposition rates of alternatives to plastic (our central estimate is paper decomposes 4,500 times faster than polystyrene) 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, this may underestimate the benefit in the cases where items are not cleared up in the time taken for paper to decompose.

¹¹⁷ Eftec (2021) Amenity Value Benefits of a Deposit Return Scheme for Drinks Containers

¹¹⁸ ONS (2020) [Families and households](#)

¹¹⁹ Resource Futures (2018), using Based on KBT (2014) study for England – litter composition minus chewing gum staining

¹²⁰ Plastic: Chamas et al (2020) Plastic: [Degradation Rates of Plastics in the Environment](#).

Resource futures (2018) [A preliminary assessment of the economic impacts of a potential ban on expanded polystyrene food and beverage containers](#)

Polystyrene decomposition rate in soil is estimated to be 8,500 years. Paper decomposition rate in soil is estimated to be 0.1 years. We use soil environments as a proxy for terrestrial litter environments.

¹²¹ We have not modelled 'reduced terrestrial litter benefit' for the first 0.1 years of the policy due to the paper alternatives taking 0.1 years to decompose. This approach is in line with previous single-use plastic ban IA's, such as the straws ban.

Monetisation of benefits associated with reduced coastal clean-up

Harbours and marinas have litter cleared in order to ensure that their facilities remain clean, safe and attractive for users. Mouat et al. (2010)¹²² estimate that UK municipalities spend approximately £15.5 million each year removing all forms of beach litter, and £2.1 million each year on harbours.

Single-use EPS food and beverage containers are estimated to make up 1.80% of all marine litter¹²³ based on item volume (as shown in table 5). We multiply this by the total annual litter clean-up costs in beaches and harbours, taking into account that only 65%¹²⁴ of the total costs are assumed to be variable. This estimate was then scaled down to England using 2020 ONS population factors.

We then account for the difference in the decomposition rates between plastic and alternative material items, following the same method outlined above, to reflect that paper food and beverage containers will be present in the marine environment for a significantly shorter period of time, leading to fewer items found.¹²⁵

To calculate the impact of the ban, we then adjust using the difference in the market share between the ban and no ban scenario, relative to the 2018 market share. Since this cost is in 2010 prices, we inflate it to 2020 prices as the standard price base year before inputting this cost into the BIT calculator. This results in a present value benefit of £0.5m over the appraisal period.

Production Emission Savings

The alternative materials to plastic are less emission intensive upon production. This means that the ban will deliver production-related savings, for our monetisation we only account for those savings that will occur within England. Resource Futures have reported that for EPS food and beverage containers, 95% of the market is supplied by domestic manufacturers.¹²⁶

Monetisation of production emissions benefit

The decrease in emissions during production can be monetised using government carbon prices.

- Polystyrene is associated with 3.78 tonnes of CO₂e per tonne of material production.¹²⁷
- We have estimated the total number of 0.65 billion food and beverage containers produced in England. This was based on the total number of food and beverage containers consumed in England multiplied by the domestic share of the market (95%).¹²⁸
- This is multiplied by the respective unit weight of the product to find total tonnage of each product produced domestically. Total tonnage is then multiplied by the emissions per tonne of the EPS/EPS alternative material, in this case paper. Paper is associated with 0.919 tonnes CO₂e per tonne of material production.¹²⁹ The difference between the emissions resulting from the EPS food and beverage container production and the alternative material food and beverage container production is the production emission savings benefit.

¹²² Kimo International (2010) [Economic Impacts of Marine Litter](#). Figure based on exchange rate of £1 = EUR 1.16 (21/05/2021)

¹²³ Based on KBT (2014) study for England – litter composition minus chewing gum staining

¹²⁴ 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.

¹²⁵ We have not modelled 'reduced coastal clean-up cost' benefit for the first 1.88 years of the policy due to the paper alternatives taking 1.88 years to decompose. This approach is in line with previous single-use plastic ban IA's, such as the straws ban.

¹²⁶ Resource futures (2018) [A preliminary assessment of the economic impacts of a potential ban on expanded polystyrene food and beverage containers](#)

¹²⁷ BEIS, Greenhouse Gas Reporting Conversion Factors

¹²⁸ For simplicity, we have assumed the same market share for all food and beverage containers as EPS due to a lack of relevant data, this may underestimate the domestic emissions savings from the policy

¹²⁹ BEIS, Greenhouse Gas Reporting Conversion Factors

- To calculate the production emission savings caused by the ban we have then adjusted to account for market growth and the difference in market share of the banned items between the ban and no ban scenarios - see counterfactual section above. The production emission savings result in a present value saving of £0.4m over the 10-year appraisal period.

Non-monetised Costs and Benefits

Summary of non-monetised costs

Excess Stock

If businesses stockpile more EPS containers than they can use before the ban is implemented, there is a risk they will be left with excess stock, which they may need to pay to dispose of. This is considered very low risk, as the government response announcing the ban has been published 9 months before implementation, giving businesses adequate time to switch to readily available alternative materials. Also, single-use plastic bans have been in the public domain for a significant amount of time, with the Resources & Waste Strategy, published in 2018, setting out potential bans. A ban on plastic straws, buds and stirrers was implemented in 2020, and the 2021 consultation on banning the supply of commonly littered single-use plastic items.

Additionally, similar single-use items have been banned in other countries, such as Scotland. Therefore, many businesses would have anticipated these bans. Engagement with Scottish Government officials has suggested that the Scottish Government's ban in 2022 on EPS containers did not lead to significant issues with excess stock.

We have discussed the matter of excess stock costs with a representative of UK Hospitality. Following discussions with their members, they stated they do not believe excess stock is likely to be an issue for most businesses, with many already transitioning towards alternative material products and unlikely to be holding months' worth of stock of single-use plastic items. This discussion was held with the assumption of an April 2023 implementation date, rather than October 2023. This delay to the implementation date further decreases the likelihood of excess stock costs being incurred, giving businesses more time to adapt.

Wholesaler impacts

The wholesale sector is likely to be able to continue to trade the alternative material items replacing the banned items. There is a risk that some wholesalers could see reduced trade or margins, particularly during a transition period from plastic items to alternative materials, which may initially be harder to source. There may be some increased costs to wholesalers if they are required to source a greater proportion of their stock from abroad than prior to the bans¹³⁰. This could also result in longer lead times for customers.

Summary of non-monetised benefits

Reduced damage to marine life

Plastics are the largest, most harmful and persistent fraction of marine litter, accounting for at least 85 per cent of total marine waste.¹³¹ It is estimated that 1.5-4.5% of all global plastics production ends

¹³⁰ A Foodservice Packaging Association members survey on the impact of this set of bans (EPS, plates and cutlery and balloon sticks) indicated that the majority of alternative material items are likely to be sourced from outside of the UK.

¹³¹ UNEP (2021) From Pollution to Solution: Marine Litter and Plastic Pollution Global Assessment

up in the ocean every year¹³². In 2019, 6 million tonnes of plastic ended up in aquatic areas globally¹³³. These items can break down and be ingested by marine life up and down the food chain. Nearly 700 different marine species are affected by plastic ingestion and entanglement¹³⁴. It has been estimated that 50% of marine mammals, 40% of seabirds and all turtle species have been known to ingest plastic¹³⁵. 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 starvation¹³⁶. Furthermore, microplastics can absorb harmful substances such as endocrine disrupting chemicals (EDCs) that can disrupt the hormonal equilibrium of marine life¹³⁷. 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.¹³⁸

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.¹³⁹

Given that EPS food and beverage containers contribute to marine litter¹⁴⁰, 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)¹⁴¹ while the monetary value of losses of marine natural capital is estimated to be as high as US\$ 2,500 billion per year (£1,860bn)¹⁴². The European commission estimated that the cost of marine litter to the EU fishing industry could amount to almost €60 million¹⁴³. 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.

Other natural capital benefits

Banning single use EPS food and beverage containers will help to conserve natural assets and improve air quality. Where single use EPS food and beverage containers are made from virgin plastic, they will contribute to depletion of natural assets, specifically fossil fuels. The production of plastic also pollutes air quality. Over 99% of plastic is made from petrochemicals derived from fossil fuels, which release hazardous air pollutants during extraction. Oil and gas drilling can release many toxic air contaminants including benzene, carbon monoxide, ethylbenzene, hydrogen sulphide, ozone, particulate matter, sulphur dioxide, toluene, volatile organic compounds and xylene.¹⁴⁴

¹³² Science (2015) [Here's how much plastic enters the ocean each year](#)

¹³³ OECD Global Plastic Outlook,

¹³⁴ Centre for Biological Diversity [Ocean Plastic Pollution](#)

¹³⁵ Estimates from Centre for Environment, Fisheries & Aquaculture Science

¹³⁶ [Cotton bud project](#)

¹³⁷ Chen et al (2019) <https://www.sciencedirect.com/science/article/pii/S0160412019303137>

¹³⁸ UNEP (2021) From Pollution to Solution: Marine Litter and Plastic Pollution Global Assessment

¹³⁹ UNEP (2021) From Pollution to Solution: Marine Litter and Plastic Pollution Global Assessment

¹⁴⁰ 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

¹⁴¹ Exchange rate value as of 17th November 2021

¹⁴² UNEP (2021) From Pollution to Solution: Marine Litter and Plastic Pollution Global Assessment

¹⁴³ European Commission [Our Oceans, Seas and Coasts. Good Environmental Status Descriptor](#)

¹⁴⁴ Naturaler (2019) [How Does Plastic Pollution Affect the Air? - Naturaler](#)

A ban will also mitigate damage to land quality. When plastics are not properly disposed of, they can degrade land quality. Plastic is produced using toxins and these toxic chemicals can leach into the soil used for growing food. Plastic can also block storm drains and culverts, which can cause or worsen flooding and bank erosion.¹⁴⁵

Furthermore, a ban will provide targeted action to address the ever-growing issue of marine plastic pollution therefore improving water quality. Globally in 2019 there was 2.7Mt of microplastics leakage and 6Mt of plastic aquatic leakage. The accumulated stock of plastics globally is estimated to be 109Mt in rivers and lakes, and 30Mt in oceans.¹⁴⁶ These plastics cause harm to terrestrial and marine life as discussed in this impact assessment and degrade the water quality further with toxic compounds.

Improvements to human health

Furthermore, research is gradually revealing the impact that this marine plastic pollution could have on human health. The decomposition of plastics leads to microplastics. When marine life ingests plastic, the toxins in microplastics can be transferred up the food chain and can be ingested by humans¹⁴⁷. 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 recent years, but the impact of human microplastic consumption is still unclear^{148 149}. The decomposition of plastics leads to microplastics. When marine life ingests plastic, some studies suggest the toxins in microplastics can be transferred up the food chain and can be ingested by humans¹⁵⁰. Human uptake of microplastics via seafood is likely to negatively impact coastal and indigenous communities where marine species are the main source of food. It is estimated that humans consume 5g of plastic a week – the equivalent of a credit card.¹⁵¹ Microplastics have also been found in human blood.¹⁵² and a study which exposed human alveolar cells to polystyrene microplastics saw inhibition of cell proliferation and changes in cell morphology.¹⁵³ Furthermore, babies and children may be more exposed to microplastics than adults. A recent study comparing stool samples of infants and adults¹⁵⁴ found that “the estimated mean daily exposures from the diet of infants to PET¹⁵⁵ and PC¹⁵⁶ microplastics were 83,000 and 860 ng/kg body weight per day, respectively, which were significantly higher than those of adults (PET: 5,800 ng/kg-bw/day; PC: 200 ng/kg-bw/d). This suggests that infants are exposed to higher levels of microplastics than adults.”

Additionally, Styrofoam/EPS products, which contain carcinogenic chemicals like styrene and benzene, are highly toxic if ingested, damaging the nervous systems, lungs and reproductive organs. The toxins in Styrofoam containers can leach into food and drinks.¹⁵⁷

¹⁴⁵ KWRC (2021) [Plastics Reduction | kennebecasisriver](#)

¹⁴⁶ OECD (2022) [Global Plastic Outlook](#)

¹⁴⁷ National Geographic (2017) [Ocean Life Eats Tons of Plastic](#)

¹⁴⁸ World Health Organisation (2019) [Microplastics in Drinking Water](#)

¹⁴⁹ Cox et al (2019) [Human consumption of microplastics](#)

¹⁵⁰ National Geographic (2017) [Ocean Life Eats Tons of Plastic](#)

¹⁵¹ WWF (2019) [plastic ingestion web spreads 1.pdf \(panda.org\)](#)

¹⁵² Leslie et al (2022) [Discovery and quantification of plastic particle pollution in human blood](#)

¹⁵³ Goodman et al (2021) [Exposure of Human Lung Cells to Polystyrene Microplastics Significantly Retards Cell Proliferation and Triggers Morphological Changes](#)

¹⁵⁴ Zhang et al (2021) [Occurrence of Polyethylene Terephthalate and Polycarbonate Microplastics in Infant and Adult Feces](#)

¹⁵⁵ Polyethylene terephthalate

¹⁵⁶ Polycarbonate

¹⁵⁷ UNEP (2018) [Single-use plastics – A roadmap to sustainability](#)

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 food and beverage containers correctly will be reduced and therefore consumers will litter more or not recycle food and beverage containers as frequently. Following a ban on EPS cups in San Francisco in 2007, waste audits indicated that while there was a 34% reduction in littered cups in 2009 relative to the 2007 baseline, littering of paper cups increased by 141%.¹⁵⁸ However, our ambition is that the ban will raise people's awareness of the environmental damage single use plastic items can cause, which may lead consumers to dispose of them correctly.
- **Increase in prices:** Some suppliers may be forced to increase prices of single-use food and beverage containers made from alternative materials in the short term due to excess demand around the ban. There may also be an incentive to use the forced change in material following the ban as an opportunity to impose price rises on consumers.
- **Inadequate provision of exemptions:** This would impose welfare costs on those who rely on using single-use plastic food and beverage containers in their everyday lives.
- **Stockpiling of single-use plastic EPS food and beverage containers:** There is a risk that some members of the public may stockpile single-use plastic food and beverage containers in anticipation of the ban being implemented, which could increase sales and result in an underestimation of the number of these items being consumed after the ban is introduced. However, as the ban is on the supply of single-use plastic food and beverage containers to the end-user, rather than on preventing these items coming onto the market, there is a low risk of retailers stockpiling single-use plastic food and beverage containers for later sale, as they would be in breach of the law to do so.

Risks surrounding not imposing a ban

- **Environmental costs get worse:** If we don't impose 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 retailers have already made towards switching to food and beverage containers made from and alternative material to plastic. 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 plastic food and beverage containers without a ban. They could do so inadvertently if products are not well labelled, or consumers may find that they prefer plastic food and beverage containers. It may be that there is a time inconsistency problem where consumers state that they should not use plastic food and beverage containers 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.

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

Equality Impact Assessment

The public sector equality duty introduced the requirement for public bodies to assess whether policy proposals will unlawfully discriminate against a group of people. Defra has conducted an Equality Impact Assessment alongside this. We believe that the ban on single-use EPS food and beverage

¹⁵⁸ OECD (2021) Preventing single-use plastic waste: implications of different policy approaches.

containers will not unlawfully discriminate against any group of people. From our consultation, only 1.8% of respondents felt a ban on EPS food and beverage containers would negatively impact those with protected characteristics. Many of these responses were anecdotal or suggestions for consideration rather than clear requests from organisations or charities representing people with disabilities or mental health conditions. By contrast, when we consulted on banning single use plastic straws, many organisations and charities responded with clear, concise requests for medical exemptions which we factored into our decision making. We sought to carry out post-consultation engagement to ensure that disabled groups were not discriminated following which no objections were raised.

Competition Assessment

We acknowledge the competition impacts that arise from banning a product. As acknowledged earlier, some suppliers of single-use EPS food and beverage containers may decide to exit the market, if they do not switch to producing alternative material items.

By banning single-use EPS food and beverage containers, there may also be positive competition impacts in alternative material item markets through increased demand for these products encouraging new entrants to the market. This may bring the benefits increased competition drives such as innovation and greater efficiency. In turn this may reduce the impact on end suppliers modelled in this impact assessment by reducing the price of alternative material items.

Further, since the ban on the supply of single-use EPS food and beverage containers is to be applied uniformly across England it will create a level playing field for all businesses and therefore we do not expect competition issues with consumers switching to a different retailer to request these items. Businesses will also be on a level playing field as they will not be able undercut each other by offering cheaper containers made from plastic, as those will be banned. Introducing a ban in England will level the playing field with Wales and Scotland, where bans either are being proposed (Wales) or have come into force (Scotland).

Although there could be barriers to entry to new businesses entering the market in the form of higher costs of the alternative material items, this may be short lived as these items become more popular and economies of scale form. Further, retailers and hospitality businesses compete on the goods and services they offer and not on single use plastic items so any potential barriers to entry created would likely be very minimal.

Trade and Innovation Assessment

Evidence suggests that the majority of single-use EPS food and beverage containers consumed in England are manufactured within the UK due to high importation costs. High importation costs were raised during consultation and through Valpak's stakeholder interviews¹⁵⁹. Based on Resource Futures' report¹⁶⁰, we have modelled 95% domestic UK production and the remaining 5% imported. Valpak's report also supports the assumption of predominant UK production with an estimate of 60-90% being produced domestically.

If the UK has a comparative advantage in manufacturing items made from paper, this will be beneficial for UK production. Additionally, a ban on single-use EPS food and beverage containers

¹⁵⁹ Valpak Single use plastic placed on the market report for Defra (unpublished), 2022

¹⁶⁰ Resource futures (2018) [A preliminary assessment of the economic impacts of a potential ban on expanded polystyrene food and beverage containers](#)

could further strengthen the market for innovation of items made from alternative materials. This was supported in our consultation where a 'green' business said a ban would encourage them to create a wider range of products and designs.

However, a Foodservice Packaging Association members survey on the impact of this set of bans (EPS, plates and cutlery and balloon sticks) indicated that the majority of alternative material items are likely to be sourced from outside of the UK, which would increase reliance on imports.

Monitoring and Evaluation

Evaluation plan

Defra made a commitment in the Resources & Waste Strategy¹⁶¹ that “all significant policies, programmes and projects should be subject to comprehensive but proportionate evaluation” (p.143). In 2020, we published the Evaluation Plan. Since then, we have also published three editions of Monitoring Progress. In March 2022 we commissioned the evaluation and in November 2022, we published the Programme of Work for 2022/2023 which provides some further information on the evaluation approach.

The aim of the evaluation is to help Defra understand what has and has not been successful about key objectives and commitments of the Strategy, why and for whom. We will use that knowledge to adapt design, implementation and/or regulation, or provide additional input into the operating context to make policies more effective. Understanding what has and has not worked, why and for whom, will help inform decision making and design better resources and waste policy in the future.

The evaluation will run over at least five years and will design and deliver:

- Light-touch evaluations of key policies (**process evaluations**) that Defra will implement over the lifetime of the evaluation, kicked off at least six months after the policy's implementation, with the aim of understanding the initial outcomes of the policy and indicative progress towards longer-term outcomes.
- **Impact evaluations** covering high-level policy outcomes of the policies.
- An **economic evaluation**, comprising a cost-benefit analysis of each of the policies and estimates of the cost/benefit ration of making the progress to date towards achieving the policy outcomes.

Six high-level desired policy outcomes (POs) of the Strategy will be assessed:

- a. PO1: More products are regularly retained, reused, repurposed, refurbished or remanufactured;
- b. PO2: Recycling rates for households, businesses, municipal waste increase;
- c. PO3: Household, municipal and business waste streams improve in quality;
- d. PO4: Plastics waste is prevented at all stages of the plastics life cycle; and,
- e. PO5: Waste crime is reduced.
- f. PO6: Food Waste is prevented

In addition, 12 policy evaluations will be conducted. This set of single-use plastic bans (EPS, plates and cutlery and balloon sticks) is one of the key policies for which a policy evaluation will be undertaken as part of this programme. This policy will also be considered and evaluated as part of PO4: Plastic Waste is prevented at all stages of the plastic life cycle, given that it is one the policies expected to have the greatest effect on plastic waste prevention.

¹⁶¹ <https://www.gov.uk/government/publications/resources-and-waste-strategy-for-england-monitoring-and-evaluation>

In February 2022 we appointed a consortium led by Ipsos, to deliver the evaluation of the Strategy. The evaluation started in February 2022 with pre-implementation activities and planning for baseline data collection taking place so far. Data collection and reporting will be delivered over the course of five years starting in March 2022, and a final synthesis report will be produced at the end of the programme in 2027 which will draw together the findings from all evaluation activity. The policy process evaluation will take place six months after the policy has been implemented (Spring 2024).

As part of the evaluation, a list of indicators of change based on the Theory of Change for the policy are being developed. This will include measurable, meaningful and proportionate indicators of outcomes (or proxy indicators) and impacts. A Data Collection Plan will be produced in 2023 outlining available data sources, identifying data gaps and new approaches to gathering necessary data to fill in these gaps. This will consider and be linked to the existing Monitoring Progress and the 25 Year Environment Plan indicators as well.

The evaluation budget is £2.5 million for 2022 - 2027, with £300,000 committed for FY23/24.

Indicative timeline:

Scoping	May-22
Development of Theory of Change	June - Feb 2023
Indicator plan & monitoring data collection plan	Jan 22- March-23
Baseline data collection	July 23 – Sep 23
Process evaluation	2023 - 2025
Impact evaluation	2023 - 2027
Economic evaluation	2027

Small and Micro Businesses Assessment (SaMBA)

Businesses in the Accommodation and Food Services sector will bear the business costs of the ban directly linked to the volume of EPS used (waste management costs, the cost of switching to higher priced paper items and fuel costs). Small and micro businesses account for 39% of the turnover of businesses in the Accommodation and Food Services group. As illustrated in Table 7, large businesses account for almost half of the size of the market by turnover.

Table 7: Breakdown of total turnover of businesses in Accommodation and Food Services in England, by employment bands

England	Employment size band			
	Micro (1 – 9 employee s)	Small (10 – 49 employee s)	Medium (50 – 249 employee s)	Large (250 or more employee s)
I: Accommodation and Food Services	19%	20%	13%	49%

.Source: ONS¹⁶². Total does not sum to 100% due to rounding.

The above turnover split could be used as a proxy for use of EPS items by business size. However, this would likely underestimate the costs to small and micro businesses. As identified by Resource Futures¹⁶³ and confirmed through our engagement with UK Hospitality, larger businesses are more likely to have already switched to alternative material items than smaller businesses. Larger businesses are more able to benefit from economies of scale when purchasing alternative material items and may also have switched to enable use of own-branded items, for example paper boxes, which are more suitable for printing.

Acquiring accurate data on the split of use of EPS items by business size would require a large-scale survey and is not proportionate for this analysis. Recognising that available data (turnover) would underestimate EPS use for small and micro businesses, we have instead modelled an upper and lower scenario range.

We have modelled the scenarios below, reflecting that the majority of remaining EPS use will be in small and micro businesses.

Table 8: Sensitivity scenarios on use of EPS by business size, modelled by Defra

	Micro	Small	Medium	Large
Lower scenario	35%	35%	15%	15%
Upper Scenario	45%	45%	5%	5%

Applying these percentages to the costs incurred by businesses which are directly linked to the volume of EPS used results in the following split.

Table 9: 10-year Net Present Value of business costs relating to EPS use, by business size, lower scenario (millions)

	Micro	Small	Medium	Large
Waste Management Costs to Businesses	-£0.010	-£0.010	-£0.004	-£0.004
Paper boxes costs to businesses	-£11.797	-£11.797	-£5.056	-£5.056
Fuel costs	-£0.417	-£0.417	-£0.179	-£0.179

Table 10: 10-year Net Present Value of business costs relating to EPS use, by business size, upper scenario (millions)

	Micro	Small	Medium	Large
Waste Management Costs to Businesses	-£0.013	-£0.013	-£0.001	-£0.001
Paper boxes costs to businesses	-£15.168	-£15.168	-£1.685	-£1.685
Fuel costs	-£0.537	-£0.537	-£0.060	-£0.060

¹⁶² ONS, (2018) [Enterprises in England by SIC section, turnover and employment size - Office for National Statistics \(ons.gov.uk\)](#)

¹⁶³ Resource futures (2018) [A preliminary assessment of the economic impacts of a potential ban on expanded polystyrene food and beverage containers](#)

Familiarisation costs are not directly linked to the volume of single-use plastic items used. We have precautionarily assumed that every business within the impacted sectors will incur familiarisation costs. We estimate the distributional split of the 10-year NPV of familiarisation costs using the business numbers below, obtained from the ONS.¹⁶⁴

Table 11: Breakdown of number of businesses in England under the scope of the bans, by employment bands, excluding exemptions

England	Employment band				Total
	Micro (1 – 9 employees)	Small (10 – 49 employees)	Medium (50 – 249 employee s)	Large (250 or more employee s)	
SIC code					
4711 : Retail sale in non-specialised stores with food; beverages or tobacco predominating	21,086	2,017	117	37	23,257
4729 : Other retail sale of food in specialised stores	2,798	400	29	4	3,231
4781 : Retail sale via stalls and markets of food; beverages and tobacco products	862	40	0	0	902
5610 : Restaurants and mobile food service activities	63,737	14,351	968	280	79,335
5621 : Event catering activities	9,590	1,070	105	31	10,796
5629 : Other food service activities	1,920	198	35	35	2,187
5630: Beverage activities	19,742	8,256	314	35	28,347
5510 : Hotels and similar accommodation	3,844	2,955	953	116	7,868
Total	123,578	29,287	2,522	537	155,923

Applying these proportions to the discounted familiarisation costs under the high scenario in the IA (45 minutes as opposed to 30 minutes) results in the split below. We have used the high scenario to avoid underestimating the cost for small and micro businesses, where familiarisation may require more time and resource.

Table 12: 10-year Net Present Value of central scenario business familiarisation costs, by business size (millions)

	Micro	Small	Medium	Large
Familiarisation costs	-£1.035	-£0.245	-£0.021	-£0.005

Producers of the banned items will face costs in the form of lost profits and capital investment as a result of the ban. The level of lost profit and capital investment per business is likely to be linked to

¹⁶⁴ Office for National Statistics, UK business: activity, size and location, 2021. (Table 4). A scaling factor of 0.843, calculated using 2020 population estimates from ONS, was applied to this data to represent the share that is England. We then used data from the Food Hygiene Rating Scheme to identify the proportion of businesses in each SIC category which may not be in scope of the ban. We applied the proportion for businesses exempt from reporting a food hygiene rating in the hospitality sector (due to not directly handling food) to net out these businesses.

business turnover. Smaller producers of the banned items may be less likely to have the capital required to adjust their production processes and may be at a greater risk of going out of business.

The lower scenario has been calculated using turnover data by employment size band of the manufacturing sector.¹⁶⁵ A limitation of this data is that it relates to the manufacturing sector as a whole and is not available at a more granular level. To account for uncertainty, we have also modelled an upper scenario where a higher proportion of producer costs are born by smaller businesses. Both scenarios are shown in the table below.

Table 13: Sensitivity scenarios on split of producer costs by business size, modelled using ONS turnover data and Defra assumptions

	Micro	Small	Medium	Large
Lower scenario	5%	10%	17%	69%
Upper scenario	10%	20%	20%	50%

Applying these percentages to the discounted costs incurred by producers under the central scenario in the IA results in the following split.

Table 14: 10-year Net Present Value of producer costs, by business size, lower scenario (millions)

	Micro	Small	Medium	Large
Capital investment costs	-£3.257	-£6.263	-£10.899	-£44.623
Producer profit loss	-£0.119	-£0.228	-£0.397	-£1.625

Table 15: 10-year Net Present Value of producer costs, by business size, upper scenario (millions)

	Micro	Small	Medium	Large
Capital investment costs	-£6.504	-£13.009	-£13.009	-£32.522
Producer profit loss	-£0.237	-£0.474	-£0.474	-£1.184

Overall, the costs to businesses with the lower and upper scenario distributions applied are summarised in the below tables.

Table 16: 10-year Net Present Value of business and producer costs, by business size, lower scenario (millions)

	Micro	Small	Medium	Large
Waste Management Costs to Businesses	-£0.010	-£0.010	-£0.004	-£0.004
Paper boxes costs to businesses	-£11.797	-£11.797	-£5.056	-£5.056
Fuel costs	-£0.417	-£0.417	-£0.179	-£0.179
Familiarisation costs	-£1.035	-£0.245	-£0.021	-£0.004

¹⁶⁵ [Enterprises in England by SIC section, turnover and employment size - Office for National Statistics \(ons.gov.uk\)](https://ons.gov.uk)

Capital investment costs	-£3.257	-£6.263	-£10.899	-£44.623
Producer profit loss	-£0.119	-£0.228	-£0.397	-£1.625
Total	-£16.636	-£18.961	-£16.557	-£51.492

Table 17: 10-year Net Present Value of business and producer costs, by business size, upper scenario (millions)

	Micro	Small	Medium	Large
Waste Management Costs to Businesses	-£0.013	-£0.013	-£0.001	-£0.001
Paper boxes costs to businesses	-£15.168	-£15.168	-£1.685	-£1.685
Fuel costs	-£0.537	-£0.537	-£0.060	-£0.060
Familiarisation costs	-£1.035	-£0.245	-£0.021	-£0.004
Capital investment costs	-£6.504	-£13.009	-£13.009	-£32.522
Producer profit loss	-£0.237	-£0.474	-£0.474	-£1.184
Total	-£23.494	-£29.445	-£15.250	-£35.457

Mitigation assessment

When considering businesses which use EPS items, the analysis above shows that small and micro businesses will bear a significant proportion of the cost, due to their slower transition away from these items compared to larger businesses. Exemptions or partial exemptions from the regulation would not be appropriate as the majority of the ban's benefits would be lost, given the majority of EPS use comes from these small and micro businesses. In the case of our upper modelled scenario, where small and micro businesses combined use 90% of EPS food and beverage containers, an exemption for these businesses would result in the loss of 90% of the benefits of the policy, which all relate to reduced EPS use.

An extended transition period or temporary exemption would not result in lower transition costs for small and micro businesses as they would still incur familiarisation costs. Temporary measures would only be appropriate to alleviate any excess stock costs but as outlined above the ban's implementation date has already been moved back 6 months, minimising this risk, and our engagement with industry has shown that excess stock is not expected to be an issue.

There are no appropriate different requirements by firm size that could be introduced. Compliant businesses are not expected to face any enforcement-related costs, due to the reactive enforcement method chosen. Therefore, differing inspection regimes by business size are not a relevant option.

Defra will provide guidance on these bans for all impacted businesses. Though this is unlikely to be tailored specifically to small and micro businesses, Defra will ensure this guidance is circulated as early as possible through trade associations, to help ensure all businesses (particularly smaller ones) are aware of the requirements.

Financial re-imbursment of compliance costs for smaller businesses would not be appropriate or feasible. Given the market structure of the impacted sectors, this would involve financial aid to the majority of businesses impacted by the regulation. The largest cost for the majority of small and micro businesses will be the higher unit cost of alternative material items. There would be no accurate and proportionate method of determining the level of cost incurred by each impacted business, to provide

financial aid to cover this. These costs may reduce through economies of scale from increased production of alternative material items following the implementation of the ban.

A voluntary or opt-in approach for smaller businesses would be likely to see the majority of the benefits of ban lost, as for an exemption, given the majority of EPS use is from small and micro businesses.

Though the ban does not directly prevent production of EPS items, domestic producers will no longer be selling EPS items to domestic businesses. Therefore, they will incur a loss of profit from these sales and potentially a capital investment cost to switch to producing alternative material items. Some of these impacts may fall on small and micro producers. It would not be logical or enforceable to allow continued use of only EPS items produced by small or micro businesses. Therefore, no exemptions for small and micro producers are appropriate.

Medium Businesses Assessment

Tables 16 and 17 show the NPV's of costs we expect to be incurred by medium sized businesses, using the ONS definition of a medium sized business (50-249 employees). These are -£16.56m (lower scenario) and -£15.25m (upper scenario).

We recognise that the new Better Regulation Framework guidance classifies medium sized businesses as having an employment size band between 50-499 employees. As ONS data is unable to provide an estimate for the number of businesses with an employment size band between 50-499, we have used Nomis data to provide an approximate estimate. Table 18 shows the number of businesses in the 50 – 499 employment size band, as obtained through Nomis¹⁶⁶ data. This suggests that there may be approximately 380 more businesses in scope within the 50-499 employees definition, compared to the 50-249 employees definition. Data showing a turnover split including this size band was not available.

Table 18: Breakdown of number of businesses in England under the scope of the ban – medium (50 – 499 employment size band) businesses

England			
SIC code	Total 50 – 499 size band	Percentage exempt	Total (excluding exempt businesses)
4711 : Retail sale in non-specialised stores with food; beverages or tobacco predominating	115	13%	100.05
4729 : Other retail sale of food in specialised stores	35	13%	30.45
4781 : Retail sale via stalls and markets of food; beverages and tobacco products	0	13%	0
5610 : Restaurants and mobile food service activities	1,180	1%	1168.2
5621 : Event catering activities	165	8%	151.8
5629 : Other food service activities	50	8%	46
5630 : Beverage serving activities	410	8%	377.2

¹⁶⁶ Nomis, UK business counts – entered by industry and employment size band. Filtered to private sector businesses and for the year 2020.

5510 : Hotels and similar accommodation	1,085	5%	1030.75
Total	3,040		2904.45

As outlined in the SaMBA, an exemption for small and micro businesses would render the policy ineffective and would hinder achieving its objectives. Therefore, an exemption which also included medium businesses would further hinder the policy from achieving its objectives.

Sensitivity analysis: Consumer pass-through

The largest annual costs associated with the policy, aside from capital investment costs, arise from the higher unit price of paper food and beverage containers compared to EPS equivalents. As per RPC guidance, the main analysis assumes that the entirety of those costs will be absorbed by businesses.

Although we do not have an estimate for the price elasticity of demand for these items, responses received in the public consultation suggested that this price difference is unlikely to be borne solely by businesses and is likely to be passed on to consumers in full, in the form of higher prices. As discussed earlier in this document, the majority of businesses impacted by the ban use single-use food and beverage containers as a complement to the main good (food or beverages) or the service (takeaway, delivery) which they provide on the market, so it is also possible that the higher per unit price of paper items may partially be absorbed by these businesses.

To address this uncertainty, we modelled a set of sensitivity scenarios where:

- businesses absorb 40% of the costs associated with higher per unit price of paper food and beverage containers and pass the remaining 60% on to consumers;
- businesses pass these costs on to consumers in full.

Table 19 illustrates the split in consumer burden:

Table 19: Consumer burden		
	Consumer pays	Businesses pay
Low	100%	0%
Central	60%	40%
High	0%	100%

Tables 20 below presents the impact on businesses and consumers over the 10-year appraisal period

Table 20: 10-year NPV impact on business and consumers of different apportioning of higher paper container unit costs

	Low	Central	High
NPV consumers	-£25.3m	-£18.7m	£0.0
NPV businesses	£0.0	-£12.4m	-£38.9m

