

# Sky Lanterns, Single-Use Barbecues and Helium Balloons

Risks and Mitigation Options

Final Report

March 2023



## Report For

Department for Environment, Food & Rural Affairs (Defra). Defra is a ministerial department, supported by agencies and public bodies. Defra is responsible for improving and protecting the environment, aims to grow a green economy and sustain thriving rural communities and supports the UK's food, farming and fishing industries.

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# Executive Summary



# Background and Purpose

Eunomia Research & Consulting Ltd (Eunomia) has been commissioned by the Department for Environment, Food and Rural Affairs (Defra) to undertake a study to investigate three items that have been associated with environmental harm: single-use barbecues, sky lanterns, and helium balloons. The primary potential impacts causing concern are fire (single-use barbecues and sky lanterns), litter (all three items), and animal welfare (all three items). Other risks also exist, including to aviation safety (sky lanterns and helium balloons) and false callouts with coastal rescue (sky lanterns only).

This study provides:

- An up-to-date and robust evidence base to describe the environmental and social risks and costs for each item.
- A summary of both existing measures and proposed measures being taken to mitigate risks related to each item, including consideration of evidence from local, regional, and national governments, in England, the UK, and internationally.
- Consideration of a range of national policy interventions, and specifically development and analysis of four primary interventions, each of which has been modelled using Cost-Benefit Analysis (CBA). There are also additional areas to explore that could further improve understanding in this issue area.

## Methodology

The methodology for this study involved three distinct stages, shown in **Figure 0**. Risk assessment principles were key to the conceptual approach taken, with evidence sought on the frequency and scale of item use and adverse impacts occurring to prioritise areas for investigation.

**Figure 0: Methodological approach**



Stakeholders from a range of sectors were contacted and engagement involved both online interviews and tailored question sheets sent via email. The approach was both targeted and flexible, with a focus on filling the most important evidence gaps. Evidence collection focused on changes since 2013 in the case of impacts from sky lanterns and helium balloons, both of which were subjected to earlier analysis at that point. However, the identification of formal intervention options for those two items was largely new ground, while single-use barbecues were looked at afresh across all dimensions of the problem.

The initial data-gathering process was used to both formulate the policy options and provide the data needed to model the cost-benefit analysis of each policy option (see the Policy Appraisal section below).

# Evidence of Impacts, Measures and Interventions

This study has assessed the following impacts related to the three items: fire risk, litter, animal welfare and ecology, human health, aviation safety, and coastal rescue. The risk associated with these impacts from the three items is summarised in Table , with the workings behind this data laid out in the main body of the report.

**Table 0: Impacts of single-use barbecues, sky lanterns and helium balloons**

Identified Risks and Impacts	Item		
	Single-use barbecues	Sky lanterns	Helium balloons
<b>Fire risk</b>	An estimated 2,431 wildfires are caused by single-use barbecues per year. There are also bin fires and potential fires where the ignition source is not appropriately attributed.	Limited data but the potential to cause significant damage in isolated incidents.	N/A
<b>Litter</b>	Beach litter data up to 2020 suggested that single-use barbecue litter has been declining.[1], [2]  However, a survey by Keep Britain Tidy found 88% of local authorities responding reported issues with litter from single-use barbecues.[3]	Limited data but estimated that 1.9 million sky lanterns end up as litter per year.	Potential decrease in balloons in beach litter.[1], [2] Deliberate and accidental release decline likely due to cost factors and changing practices around events such as mass releases.[4]
<b>Animal welfare and ecology</b>	Safety concerns for pets burning their paws due to littered single-use barbecues on beaches, as well as wildfires causing loss of habitat and wildlife. Both issues have limited data and are difficult to quantify.	Limited data but estimated that one in ten incidents are reported[5] so the risk could be higher than reported.	Reports of terrestrial and marine animals choking (and potentially dying) from balloons, but potential underreporting and no conclusive figures.

<b>Human health</b>	The estimated cost of major burns due to single-use barbecues is approximately £1.8 million per year in England.	N/A	N/A
<b>Aviation safety</b>	N/A	Between 2012 and 2022, there were 26 Mandatory Occurrence Reports to the Civil Aviation Authority where there was interference with an aircraft from a sky lantern.[6]	Between 2012 and 2022, there were 146 Mandatory Occurrence Reports to the Civil Aviation Authority where there was interference with an aircraft from a balloon.[6]
<b>Coastal rescue</b>	N/A	Limited data but estimated that risk has likely declined since 2013, due to reduced product sales and use.	N/A

In the UK, a range of local or voluntary interventions have been undertaken. For single-use barbecues, examples include (but are not limited to):

- **Retailers halting sales of single-use barbecues** (both at the national and local scale) due to fire risk concerns, at least temporarily.
- **Specialist bins and designated safe barbecue areas** have been provided by some local authorities to tackle litter and fire concerns.
- **A range of local enforcement and restriction powers** exist that can be used to tackle behaviours around these items. Public Spaces Protection Orders (PSPOs) were a particular measure identified as relevant by local authorities contacted for this research. PSPOs can be used to ban the use of single-use barbecues on designated public land and allow a fixed penalty notice of £100 to be issued to anyone in breach of this measure.

For sky lanterns and helium balloons, examples include (but are not limited to):

- **Ban of release on council-owned land** by some local authorities, including the possibility of making the release an offence under a PSPO (no fines have yet been enforced for the release of these items)
- **Industry product changes and a Code of Practice for sky lanterns**[7], including materials used, colour, size, shape and biodegradability to reduce the risk of all types of impact.
- **Changed industry guidance on practices such as the mass release of helium balloons**[8]
- **Removal of sky lanterns from sale by supermarkets**

Internationally, national bans on sky lanterns sales exist (e.g., Germany and Brazil), while policy approaches like Extended Producer Responsibility (EPR) are being explored for balloons in some European jurisdictions.

# Policy Appraisal

Four policy options were developed and explored in detail via a Cost-Benefit Analysis (CBA) which compared each intervention against a baseline. Three policy options related to single-use barbecues (which the preceding evidence stages identified as a higher concern), and one option related to sky lanterns. No policy option was modelled for helium balloons due to their potential risks being less severe than the other two items, especially given a decline in sales, and evidence of a decline in releases.

There were some challenges in calculating adverse impacts from these items for the purpose of a model baseline. Incidents may be significantly under-reported (e.g., minor incidents involving sky lanterns), or under-attributed (e.g., the burden of proof before assigning a cause to a fire is very high). The assessment of baseline impacts, therefore, drew heavily on the range of evidence collected in earlier research phases, but some significant uncertainties remain. In particular, the impacts of low-frequency but high-impact events may not be well reflected in the historical impact data, and thus a judgement is still needed on tolerance of risk in assessing the CBA results.

## Policy Option 1: Total Ban on Sale of Single-Use Barbecues

This option would be a total national ban on sales of single-use barbecues, though alternative forms of a ban (such as localised or seasonal sales controls or bans on use rather than sales) were also considered during policy development. This measure would be much more comprehensive, and involve very different enforcement approaches, than a localised extension of use bans, for which Local Authorities already possess some powers.

The ban on the sale of single-use barbecues is assumed to be wholly effective in eliminating use in the model, and therefore no environmental impacts would result from use in the modelled scenario (in practice illegal import and sale might be a minor consideration). However, modelling for this measure shows a loss of £69.3 million over the 8-year period from 2023-2030, driven primarily by lost economic activity.

## Policy Option 2: EPR+

The EPR+ scheme modelled goes beyond a conventional extended producer responsibility (EPR) scheme (where cost recovery is limited to end-of-life waste management only) and the fees additionally cover the cost of:

- End-of-life management costs including litter clean-up
- A compensation fund for fire damage, claimable by designated entities including Local Authorities, National Parks, and Fire and Rescue Services
- Improved national data on costs and incidents

The end-of-life costs, damage costs and EPR scheme costs were estimated to amount to a total of £10.1 million in the first year of the scheme (2023). This cost was divided by the number of single-use barbecues sold (7.58 million) to calculate the EPR fee of £1.33 (to be added to the base price of the single-use barbecue). This changed price will also impact sales, with an associated reduction in both environmental incidents resulting, but also in economic spend on the targeted products. Putting all the cost data together and comparing it to the baseline, the policy delivers a loss of £17.5 million over the 8-year period.

## Policy Option 3: EPR++

The EPR++ scheme replicates the 'EPR+' scheme but additionally covers the costs of:

- Enforcement of localised bans on use in certain high-risk areas and/or temporary bans dependent on seasonal fire risk.
- The provision of grants to provide 'safe' barbecue use locations and specialised disposal bins, as well as localised communications.

The additional costs for the provision of safe locations for use totalled £5.59 million per year while localised campaign and communications cost £11.8 million per year (both in 2023), thus increasing the level of EPR++ fees and the level of cost passed through to consumers relative to option 2. As with option 2, this changed price reduces both the environmental impacts and economic spend on the targeted products, but by a greater extent, and the policy delivers a loss of £33.3 million over the 8-year period.

## Policy Option 4: Total Ban on Sale of Sky Lanterns

Only a ban on sales was explored as a policy option for sky lanterns, as all use cases involve an uncontrolled release of the product into the environment. The ban on the sale of sky lanterns is assumed to be wholly effective and therefore, no environmental impacts would result from their use in the modelled scenario (in practice, illegal import and sale might be a challenge, as most sales currently already occur online; and this has proved a challenge in jurisdictions elsewhere enacting bans). However, modelling for this measure shows a loss of £15.5 million over the 8-year period from 2023-2030, driven primarily by lost economic activity.

# Conclusions

As identified, there remain limitations in the data underlying the modelling. While realistic assumptions have been made on the likely cause of fire incidents and the likely frequency of littering occurrences and their consequences, this remains an area where hard data is weak, both in the normal course of events and in terms of calculating the chances of a single, catastrophic incident not seen in limited historical data. Attitudes to toleration of risk will therefore also inform the interpretation of the CBA findings. Policy measures to improve data capture might also lead to a reassessment of the measures examined here. Additionally, while in the current study, the EPR+ and EPR++ approaches showed limitations in the CBA, the principles underlining these options – that producers could be held responsible for the wider cost impacts of their products beyond simply end-of-life – may be useful for future policy evolution in this area, or for other products imposing a significant cost burden on public authorities during their use phase. These policies are achieving a desirable policy aim, in that they are redistributing costs currently borne by the public purse, and, ultimately, all taxpayers, onto those producers creating products in the first place.

In addition to the national-level options modelled above, a number of other responses to the challenges posed by the three items in this study remain relevant to consideration, including the localised or voluntary measures identified as already being deployed in some circumstances. For example, supermarkets withdrawing sky lanterns from sale over the past decade has almost certainly contributed to reductions in the use of these items. In the case of helium balloons, where no policy intervention was formally modelled, EPR is an option being investigated elsewhere, though implementation would require further data on litter prevalence to help determine costs payable by producers.



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# 1.0 Introduction

## 1.1 Objectives and Context

Eunomia Research & Consulting Ltd (Eunomia) has been commissioned by the Department for Environment, Food and Rural Affairs (Defra) to undertake a study to investigate three items that have been associated with environmental harm. These items are single-use barbecues, sky lanterns, and helium balloons.

In recent years, single-use barbecues and sky lanterns have come under particular scrutiny due to the fire hazard they pose amidst a backdrop of very hot summers and an increase in incidences of wildfires both large and small. Single-use barbecues have been a particular point of concern and are often cited as sources of ignition for wildfires in media reports. Local authorities also point to issues concerning litter, bin fires and damage to grass. Whilst the use of sky lanterns has declined in recent years (see Section 2.3.2), they are also implicated in fire risk. In the recent past, there have been cases of very high profile and damaging incidences in urban areas, such as a fire at the Smethwick recycling plant in 2013[9], as well a major fire at a zoo in Germany in 2020[10]. Sky lanterns are also associated with issues such as littering (with associated socio-economic and environmental harms for both humans and wildlife) reduced animal welfare, risks to aviation safety, and false callouts for coastal rescue services. Helium balloons, when released, share some of the impact characteristics with sky lanterns. Both helium balloons and sky lanterns were subject to a 2013 report[11] by ADAS<sup>1</sup> for Defra (Defra 2013 report from now on – see Section 2.2), though this was focused primarily on impact, and not also on potential policy responses as in the current report. The current report, therefore, focuses on changes since 2013 for questions tackled in the earlier study, while treating new questions (such as the policy responses options available) and items (i.e., single-use barbecues) in more detail.

This study, therefore, aims to provide:

- An up-to-date and robust evidence base to describe the environmental and social cost of the impacts of each item.
- A summary of both existing measures and proposed measures being taken to mitigate risks related to each item, including consideration of evidence from local, regional, and national governments, in England, the UK, and internationally.
- A series of policy options, and recommendations for future research. These are principally based on four policy options that have each been modelled to provide a cost-benefit analysis of the intervention.

## 1.2 Methodology and Structure of the Report

### 1.2.1 Methodology

The methodology for this study involved three distinct stages (summarised in **Figure 1-1: Methodological approach**). A full description of the methodological approach can be found in the Appendix (Section A 2.0). Underpinning the approach were concepts relating to risk, with a key focus being on obtaining the best possible understanding of the frequency of item use, irresponsible item use and disposal, and irresponsible item use and disposal that resulted in

<sup>1</sup> Independent agricultural and environmental consultancy (UK)

negative human or environmental consequences. Where negative impacts were occurring, the focus of the study switched to potential policy intervention countermeasures.

### 1.2.1.1 Overview

Gathering the evidence to inform this study involved collecting data on the impact of the three items, as well as evidence of both existing and proposed measures for each item. Engaging with stakeholders was a key element of the data-gathering process, with much of the data not readily publicly available. Information gathered was used to both suggest each policy option, and provide the data needed to model the cost-benefit analysis in each case. This report provides a description of the impacts identified for each item, responses currently deployed or under consideration, the development of four national policy measures for formal modelling, and the outputs of each modelling scenario. Conclusions going forward are informed by these models but are not limited by them. Modelling is only as good as the evidence and assumptions that can be used, and for all three items, there are evidence limitations. As these are risk-based policy interventions, tolerance of risk will also be a key factor in deciding how to proceed. Significant considerations for the interpretation of model outputs are highlighted in reporting. Additionally, the conclusions relate to the findings from the initial evidence-gathering stage which fall beyond the scope of the four policy measures directly modelled.

**Figure 1-1: Methodological approach**



### 1.2.1.2 Summary of Evidence Collection

The project team engaged with stakeholders from a range of sectors, including Fire and Rescue Services, Local Government, NGOs, academic researchers, government agencies, trade bodies, nature reserves, trading standards institutes, manufacturers and retailers of the items. Stakeholders were prioritised into Tier 1 and Tier 2 stakeholders, according to a subjective *a priori* assessment of the likelihood they would have unique information, and the number of similar stakeholders that might also be approached. Tier 1 stakeholders were mainly interviewed online, whereas Tier 2 stakeholders were generally asked to fill out a tailored question sheet. The availability of specific stakeholders, and the number of stakeholders contacted and responding in different groups, led to a deliberately flexible approach in practice, with a focus on pursuing the most important evidence gaps. A full list of stakeholders can be seen in the Appendix (Section A 3.0).

### 1.2.1.3 Summary of Policy Measure Modelling

Policy options were developed after the initial evidence-gathering stage, based on the case for action, the evidence on potential measures for these items, and the project team’s knowledge of transferable policy instruments used for other environmental issues in the UK and internationally. These options were discussed with Defra and four policy scenarios were taken forward for analysis. A description of the different policy options is given below, with further detail given in Section 6.0.

- **A ban on the sale of single-use barbecues**
- **An ‘EPR +’ scheme for single-use barbecues**

In contrast to a conventional EPR scheme (where cost recovery is limited to end-of-life waste management only), this approach would ensure that manufacturers of single-use barbecues cover costs arising from their products’ irresponsible use. In addition, there would be enforced requirements from manufacturers around labeling for responsible use, as well as sales reporting disclosure. EPR fees would cover the costs of:

  - a. End-of-life management costs including litter clean-up.
  - b. A compensation fund for fire damage, claimable by designated entities including Local Authorities, National Parks, and Fire and Rescue Services
  - c. Improved national data on costs and incidents.
- **An ‘EPR++’ scheme for single-use barbecues**

This would replicate the ‘**EPR+ scheme**’ but cost coverage would *additionally* extend to applying fire risk control measures. Specifically, these would include:

  - d. Enforcement of localised bans on use in certain high-risk areas and/or temporary bans dependent on seasonal fire risk.
  - e. The provision of grants to provide ‘safe’ barbecue use locations and specialised disposal bins, as well as localised communications.
- **A ban on the sale of sky lanterns**

No policy change was modelled for helium balloons. This was because the research team concluded that their potential risks were less severe than the other two items. In addition, a ban on sky lanterns was proposed because, from a litter standpoint, there is no responsible use of a sky lantern, which always involves uncontrolled release. In contrast, tethering a helium balloon, or indoor use, can be considered responsible use if disposed of correctly.

## 1.2.2 Structure of the report

The report is structured into the following sections:

- **Background to the items** (Section 2.0). This includes an introduction to each item, its policy context, as well its market context.
- **Evidence of impacts** (Section 3.0). Impacts are broken down into the subcategories of Fire, Litter, and ‘Other’ impacts, with ‘Other’ covering Animal Welfare, Human Health, Aviation Safety, and Coastal Rescue. For each impact, incidence frequencies as well as impact severities are given.
- **Measures and interventions** (Section 4.0). For each of the items, measures are split into existing and proposed measures. This section also includes examples of measures from other countries and a short discussion of their effects.
- **Public attitudes and perceptions** (Section 5.0). This section gives a potential insight into public opinion on the items, taken from local government consultations.
- **Policy appraisal** (Section 6.0). This section provides the outputs of the four policy options described in Section 1.2.1.3.
- **Conclusions and recommendations** (Section 7.0). This section outlines the pros and cons of each policy option that has been modelled, and a qualitative assessment of outputs. It also includes policy options that lie outside of the model, as well as recommendations for further research to fill gaps in the data.
- **Appendices**. The appendices further detail the methodology, list the stakeholders engaged, describe key assumptions made in the model with tables of data, and provide a glossary of key terms.
- **Endnotes**. The endnotes list all sources of data publicly available, or documents or reports sent to the project team by stakeholders. Where appropriate, the endnotes also indicate where information was gathered through stakeholder interviews or email correspondence. Footnotes are used throughout the body of the report to give further supporting information.

## 2.0 Background

This section briefly defines the three items of concern for the study, and the terminology used to describe them. It then summarises the current policy context and market situation for each.

### 2.1 Defining Items in Scope

All three items in scope for this study broadly align with common understandings of the terms but are worth setting out in detail in the context of a discussion about potential policy interventions or regulations.

- **Single-use barbecues:** Single-use barbecues are typically made from a lightweight aluminium material, use charcoal for the heat source, and are sold as a single package providing all of the elements required to grill food outside, usually in spring or summer. As an ignition source, their danger lies in the fact that they can reach very high temperatures, are often placed directly on the ground outside, and are often not disposed of correctly if at all (due to genuine or perceived difficulties in transporting them after use). They are also a concern due to the litter they cause, and their impact on human health and consumer safety, principally through burns. See Sections 3.1.22, 3.2.1 and 3.2.5.1 for evidence of fire, litter and human health impacts, respectively. Single-use barbecues are often referred to as ‘disposable barbecues’. However, following a prompt from a manufacturer of the item, the project team decided that the use of the word disposable promoted littering behaviour, due to the connotations between the word and throwing something away. For this reason, the term single-use barbecue is used throughout the report.
- **Sky Lanterns:** A sky lantern is a small hot air balloon made of paper, with an opening at the bottom where a small fire is suspended. They are typically 100cm high with a diameter of approximately 60cm. Many sky lanterns’ shape is retained through the use of a metal wire to act as a frame, but today sky lanterns described as “environmentally friendly” use bamboo frames, or wooden cross beams. A sky lantern’s fuel cell (made of wax, cotton or cloth) should expire mid-flight and therefore fall to the ground without presenting a fire hazard. However, this has proven to not always be the case (see Section 3.1.3 for evidence of the fire impacts from sky lanterns). Other impacts of sky lanterns include litter, animal welfare, aviation safety, and causing false call-outs for coastal rescue services (see Sections 3.2.2, 3.2.4.2, 3.2.6.1 and 3.2.7 for evidence of these impacts, respectively).
- **Helium Balloons:** Helium balloons are balloons made of latex or foil which have been filled with helium gas and sealed at the neck. They are typically used as children’s toys, party accessories or decorations, and are usually 25cm – 30cm in height. The scope of this report does not include larger balloons used in commercial applications, for example, weather balloons and large tethered balloons. Balloons that are not inflated by helium share many of the potential impact characteristics of helium balloons (although not all). The key difference is that helium balloons can be deliberately or accidentally released and are likely to be unrecoverable by the user if this occurs. In these cases, the balloon cannot be correctly disposed of and can reach places where it can cause harm. Impacts include litter, animal welfare, and aviation safety (see Sections 3.2.3, 3.2.4.3 and 3.2.6.2, respectively).

### 2.2 Policy Context

In light of the above issues presented by these items, all of them have been the subject of public calls for greater controls or bans. Action at local authority and landowner level has sometimes been taken in the UK, and national restrictions have been applied in some other jurisdictions. There are no national restrictions specifically on these items in England, though more generic powers, such as those around littering, could be considered relevant, and are discussed further in Section 4.1.1.3

For sky lanterns and helium balloons, this study follows from the Defra 2013 report.<sup>[11]</sup> The earlier report aimed to both quantify and qualitatively describe the negative impacts of these two items. In broad terms, these findings

remain relevant in that no new areas of concern have emerged. The findings of the 2013 report are therefore summarised in **Table 2-1: Summary of the Defra 2013 impact assessment for sky lanterns and helium balloons and subsequent recommendations**. This study moves forward the evidence base for these two items rather than covering the same ground, and therefore the collection of evidence for this study focuses on changes in actual or potential harm over the past ten years, as well as exploring potential interventions in detail for the first time.

The current report is the first time there has been a project seeking to establish a robust evidence base for single-use barbecues.

Policy options and further recommendations for all three items of concern are also informed by a cost-benefit analysis model, which the previous report did not provide.

**Table 2-1: Summary of the Defra 2013 impact assessment for sky lanterns and helium balloons and subsequent recommendations**

Item	Impacts				
	Fire risk	Litter	Animal welfare and ecology	Aviation safety	Coastal rescue
Sky lanterns	Significant risk – recommended design and use changes	Minor risk	Minor risk, but recognises that underreporting is high	Some risk – recommend improved consumer information by producers	Significant risk – recommended voluntary ban on red sky lanterns and improved producer advice
Helium balloons	N/A	Minor risk	Small risk, but recognises that underreporting is high	Some risk – no further recommendations made	N/A

Recently, both single-use barbecues and sky lanterns have had online petitions initiated advocating for their ban. The petition for banning single-use barbecues in the UK<sup>[12]</sup> received 27, 762 signatures before its 6-month end, and resulted in a government response stating that they are assessing the range of possible interventions, but there are currently no plans to introduce a blanket ban. A petition forwarded by the National Farmers’ Union (NFU) to ban sky lanterns currently has 97, 160 signatures and is still open at the time of writing.<sup>[13]</sup> A number of prominent organisations and charities have also campaigned for change in relation to the items. These include Keep Britain Tidy (KBT), who has campaigned strongly for a ban on single-use barbecues.<sup>[14]</sup> In October 2022, KBT sent out a survey to a range of local authorities through their Local Authority Network. The survey focused on the issues that local authorities face due to single-use barbecues and the preventative measures they are taking and showed these items were causing litter challenges. The Marine Conservation (MCS) have also campaigned for many years against the release of sky lanterns and helium balloons with their ‘Don’t let go’ campaign<sup>[15]</sup>. At Westminster, a Private Members Bill seeking prohibitions on “disposable” barbecue use on moorland was introduced in 2021, and when progress was halted by the end of the parliamentary session, a second similar bill was introduced in 2022, targeting a

broader range of areas.[16] This is discussed further in Section 4.1.2.2. In 2019, a Parliamentary Bill was proposed for a complete ban on the use of sky lanterns but failed to complete passage through Parliament.[17]

## 2.3 Market Context

This section outlines what is known about the sales and use of the three items in England. While for some items, not every sale will result in irresponsible use, it is highly likely that irresponsible use will correlate with sales, and reduced sales are therefore likely to mean reduced risks.

### 2.3.1 Single-Use Barbecues

Single-use barbecues are a popular item available in many retail outlets across England, having been first introduced to the UK market in 1986.[18] Eunomia's understanding of this market was shaped by a stakeholder interview with a large manufacturer as well as publicly available data. Based on these sources, and in the absence of comprehensive sales data, the project team estimated that approximately eight to ten million units are sold by manufacturers to retailers each year in the UK (approximately 7.5 million units sold in England annually). Eunomia also assumed, based on the stakeholder interview, that the vast majority of barbecues are manufactured domestically in the UK, though again, data for a full market assessment was limited.

Single-use barbecue sales are highly seasonal. Sales of single-use barbecues typically begin around Easter time and continue through until the end of August.[18] According to the manufacturer Eunomia spoke to, for retailers this uptick in single-use barbecues in the spring heralds 'the beginning of summer' and associated increases in sales for other products.[18] The effect of the COVID pandemic and societal 'lockdowns' accelerated the trend for outdoor living and increased the use of single-use barbecues. Sales of single-use barbecues are estimated to have increased by 50% in 2020 and 2021.[18] Supporting that estimate is evidence people in the UK held 55 million more barbecues (of all types) in 2020 than in 2019 – a 41% increase.[19] The manufacturer the project team spoke to indicated, however, that sales have since returned to more typical pre-pandemic levels. The turnover value for retailers selling single-use barbecues in England has been estimated by Eunomia as approximately £36 million per year at present.<sup>2</sup>

There are typically two forms that a single-use barbecue will take; either a standard size designed for the cooking of smaller quantities of food or a 'party size' designed for the cooking of larger quantities of food; based on manufacturer feedback, the project team estimated that 32% of sales were for party size single-use barbecues in 2022.

If considering the wider economic value of single-use barbecues to the UK economy, one might consider that single-use barbecues are typically bought with an accompanying supply of food to be cooked on the barbecue, referred to as the "additional basket spend". Additional basket spend has not been incorporated into the modelling aspect of this study<sup>3</sup> because it is too complicated to accurately determine what the basket spend might truly be in the counterfactual scenario. For example, if single-use barbecues were not purchasable, consumers might potentially spend their money on other picnicking foods or barbecuing at home with non-single-use barbecues, with similar levels of additional basket spend. Relatedly, there is also a risk of overstating the impact of reduced item sales in policy modelling of this type. For example, if money is not spent on barbecues, it is ultimately likely to be spent on

<sup>2</sup> This estimate is based on a combination of input from an industry stakeholder interview, and publicly available price information weighted for the share of sales for different sized single-use barbecues.

<sup>3</sup> However, if additional basket spend were taken into account, and assumed to be truly additional, then additional basket spend for both party size and standard size single-use barbecues is approximately £194 million in England. Assumptions behind this figure are laid out in the Appendix (Section **Error! Reference source not found.**).



substitute activities, albeit potentially in other sectors or locations. Evidence on likely outcomes in relation to these factors is not available, and Eunomia has therefore not incorporated these elements into this analysis.

## 2.3.2 Sky Lanterns

Even more so than with single-use barbecues, a comprehensive market picture is not available for sky lanterns. A sky lantern is also often imported under a variety of names which are often conflated. These include; paper lanterns, Chinese lanterns, flying candles, or even just 'balloons', which significantly complicates the task of estimating the extent of sales. Engagement with sky lantern retailers for this project was unsuccessful in generating accurate sales figures for a highly fragmented market that mainly operates through internet sales. There are approximately ten 'official' distributors of sky lanterns in the UK, but a multitude of sellers is operating from third-party platforms, which could be in the 'hundreds if not thousands'.<sup>[20]</sup> Defra's 2013 report encountered a similar challenge in estimating sales, and identified a relatively broad range in the final estimate.

Eunomia's understanding was therefore shaped by a stakeholder interview with a major sky lantern seller as well as publicly available data from previous studies. Based on this the project team estimated that sales have declined approximately 50% since 2014, though our sources do not include sellers of cheaper sky lanterns that could have been less affected by any downturn. The reduced frequency of some reported incidents involving sky lanterns also supports the conclusion that use has reduced over this period, which would align with the evidence available on sales. The project team considered it likely that much of this decline may result from negative publicity and restrictions on sales in supermarket over that period.

For the baseline and scenario modelling in this report, Eunomia has taken the estimate for sky lantern sales from Defra's 2013 report (3-8 million estimated as sold giving a 5.5 million mid-point) and applied the reduction estimated since 2014, effectively halving the number of items assumed to be sold. Our analysis therefore assumes that currently 2.25 million sky lanterns are sold each year in the UK (1.9 million in England), but there is significant uncertainty on this point.

Our interview with a major seller suggested that the majority of buyers today are individual customers, due to the reduction in mass releases of sky lanterns by event planners.<sup>[20]</sup> This reduction is likely to have been driven by higher awareness of the risks of release, resulting from bad publicity. Seller feedback also indicated that it is likely that today no sky lanterns are produced in the UK, and instead almost all items sold are imported – principally from China, but with Thailand and India also potentially significant sources.<sup>[20]</sup> The same interviewee suggested that for the market as a whole internet sales account for approximately 90% of sales in the UK, with the remainder sold in party or fireworks shops.<sup>[20]</sup> The price of a sky lantern varies significantly according to the quality and the materials used to assemble the product (see Section 4.2.1), and our stakeholder interviewee suggested prices can range from 30p to £5.00 for a single sky lantern.

## 2.3.3 Helium Balloons

The Defra 2013 report stated that, according to the European Balloon and Party Council (EBPC), the size of the entire UK balloon market in 2013 was approximately £500 million.[11] Within this, the UK market value of the helium balloon market was £150 million (30% of the market). In 2013, the helium balloon market had approximately 4,130 associated businesses and employed 21,750 employees.[11]

One major European balloon manufacturer the project team engaged with revealed that today, the UK helium balloon market is approximately 3-4% of the total balloon market in the UK, meaning that, proportionally, it may be just 10% of what it was in 2013. The Balloon and Party Industry Alliance (BAPIA) reported to the project team that approximately ten years ago helium balloons represented 75% of the décor industry market, which traditionally used a lot of helium balloons. However, today this figure was approximately 25%. Considering that a major European balloon manufacturer reported to the project team that the entire UK balloon market declares annual *profits*<sup>4</sup> of approximately £96-120 million this would mean that the annual *profit* of the UK helium market might be approximately £3.4-£4.2m. Turnover would be higher than profits of course and assuming the overall balloon market has remained static since 2013, this would mean the UK helium balloon market is worth approximately £18m.

The reason for the reduction in the helium market is due to the increase in the price of helium. Project team correspondence with BAPIA found that a typical 'small sized' helium canister which thirty years ago cost £18 (£40 accounting for inflation), costs £200 in 2022. In addition, in 2019, a director of a UK balloon and party retailer reported a 24-30% increase in the price of helium during that year.[21] Between 2011 and 2017, medical researchers in the US reported a 250% increase in helium prices.[22] Current reasons for this include the war in Ukraine since Russia is a major exporter. However, longer-term issues include declining helium reserves in countries like the US, which is responsible for 40% of exports[23], with the US National Helium Reserve in Texas, the world's single largest source of helium for the past 70 years, now exhausted.[24] Manufacturing impacts including resource use were out of scope for consideration in the current study but are a specific resource scarcity concern in the case of helium. While use in balloons is a small share of global usage (in 2017 NABAS estimated that helium used in party balloons equated to 5-7% of all helium applications[25]), helium is a finite resource, with many critical uses in medicine and industry.

## 3.0 Evidence of Impacts

This study has assessed the following impacts related to the three items: fire risk, litter, animal welfare and ecology, human health, aviation safety, and coastal rescue. Not all impacts are relevant to all items; impacts by item type are summarised in **Table 3-1**. In the case of single-use barbecues and animal welfare and ecology, the impacts are related directly to sky lanterns and helium balloons, although the potential ecological impacts from fires caused by single-use barbecues and the risks of burns to pets are also recognised and discussed.

<sup>4</sup> Accurate figures on revenue were not forthcoming through research.

**Table 3-1: Impact by item type**

Item	Impacts					
	Fire risk	Litter	Animal welfare and ecology	Human health	Aviation safety	Coastal rescue
Single-use barbecues	✓	✓	(✓)	✓		
Sky lanterns	✓	✓	✓		✓	✓
Helium balloons		✓	✓		✓	

## 3.1 Fire

Fire risk is a key reason why this study was commissioned at the current time, and arguably represents the largest single event impact from misuse of the items considered in this study. This section briefly outlines fire reporting data, before considering evidence around causation for the targeted items.

### 3.1.1 Relevant Fire Data for England

In England, fires that are attended by a Fire and Rescue Service (FRS) as incidents are classified as primary or secondary fires<sup>5</sup> and are logged on the Home Office’s online Incident Recording System (IRS).[26] *Wildfires*, defined as any uncontrolled vegetation fire, are particularly relevant for this study because single-use barbecues and sky lantern fires typically happen outdoors. The past few years have seen increasing concern about fire risk in England. Analysis of the Forestry Commission’s wildfire data shows that the total wildfire burn area for 2018-2019 was over 5 times higher than the average for 2009-2018, with 2020-21 also being substantially higher. Analysis of data supplied by The European Forest Fire Information System (EFFIS)<sup>6</sup> shows this was also the case for 2022.

Climate change is a factor that will influence fire risk in the UK, although the precise relationship is complex. In terms of future fire risk due to climate change, the UKCP18 models suggest that under a 2°C warming scenario, the number of days with a very high fire risk will be 9% higher in spring, and 27% higher in summer.[27] Climate-induced fire risk increases due to both increased temperatures, as well as reductions in relative humidity.[28] Increased fire risk may be realised as either an increase in frequency, scale of specific fires, or both.

<sup>5</sup> Primary fires are potentially more serious fires that harm people or cause damage to property and meet at least one of the following conditions: any fire that occurred in a (non-derelect) building, vehicle or (some) outdoor structures; any fire involving fatalities, casualties or rescues; any fire attended by five or more pumping appliances. Secondary fires are generally small outdoor fires, not involving people or property.

<sup>6</sup> Forestry Commission data is currently only available for up until 2021. EFFIS data runs until 2022, but only records wildfires greater than 30ha in size, whereas Forestry Commission data contains all wildfires regardless of size. The data is nonetheless comparable, because a) the majority of burn area occurs through wildfires greater than 30ha in size and b) a 22.5% uplift assumption to EFFIS data has been made to incorporate burn area for those wildfires less than 30ha in size. This is assumption has been provided by EFFIS analysts.

Wildfires occur across the country and in all the main terrestrial habitats but, by area, are particularly prevalent in moorland environments.[29] Between 2009-2017 in England, only 0.9% of wildfires occurred in ‘mountain, heath and bog’ environments, and 3% of wildfires occurred in ‘semi natural grassland’ between 2009-2017, but the majority *by area*, occurred in ‘mountain, heath and bog’ (48%) and in ‘semi natural grassland’ (11%) environments.[30] Such areas are therefore of particular note when discussing wildfire risk from items. A study of wildfire data in the Peak District led the authors to suggest that climate change may cause the timing of moorland wildfires to shift from a damper and more verdant spring to drought-stressed summer.[31]

## 3.1.2 Single-Use Barbecues

This section describes the fire risks specific to this items, evidence of the frequency of fires specific to this item, and evidence of the impact of fires specific to this item.

### 3.1.2.1 Introduction to Fire Risk

Single-use barbecues have been identified as a potential source of ignition of fires because of the high temperatures they can reach (up to 400°C[32]), and because of the length of time that they remain hot. At present, a study is being carried out by the University of Exeter’s WildFIRE Lab[33] to determine the extent to which single-use barbecues are a viable source of ignition for starting wildfires. This follows a preceding study into the viability of discarded cigarettes as an ignition source.

It is notable that some of the most high-profile and largest fires caused by single-use barbecues occur in isolated, rural environments with relatively little habitation. This is likely because: people use them recreationally whilst picnicking in scenic locations; there is a high fuel load and a comparative absence of fire breaks in these locations; and response is invariably slower in these locations. According to the England and Wales Wildfire Forum (EWWF), single-use barbecues are particularly a perceived threat because they typically begin to be used in late Spring and Summer, which is also the time when fire risk is highest due to hot temperatures and the dry conditions of the fuel load. Ignition patterns of wildfire are associated with bank holidays and weekends, demonstrating accidental incidents by recreational visitors as a significant source of wildfire risk.[34]

It is necessary to state that all figures regarding single-use barbecue fires must be approached with a strong degree of caution. At present, there is a lack of consistency in identifying and recording the ignition source of fires. There is also the issue of survival bias; the discovery of a burnt-out barbecue within a burn area is not evidence that the barbecue was the source of ignition. The UK does not routinely investigate the cause of wildfire ignitions and lacks capacity of Fire Investigators sufficiently qualified in this specialist skill.[27] According to Belcher et al, these issues are significant enough to cast ‘significant doubt’ on any of the current datasets that report on ignition sources for wildfires,[27] and are also why the Forestry Commission, the holders of wildfire data for England, do not report on the source of ignition due to its perceived inaccuracies.[35] Generally, it is unclear whether barbecue fires are subject to under-reporting or over-reporting. The Forestry Commission indicated they were wary of datasets purporting to attribute ignition sources to barbecues and that the media could be reinforcing bias in this area. However, the National Trust, when interviewed, indicated that under-reporting may be occurring when Fire and Rescue Services report on ignition sources because fire investigators – who are used to and trained for investigating criminal incidents – require very high burdens of proof before being able to definitively assign a cause.

### 3.1.2.2 Number of Incidents

This section seeks to quantify the number of fire incidents caused by single-use barbecues by analysing data from the Home Office, previous reports on wildfires and stakeholder reporting on regional areas. In addition to wildfires, bin fires have also been attributed to single-use barbecues, with more information provided below.

A number of datasets have been used to both identify and analyse fire incident frequency and severity for fires caused by single-use barbecues. The Home Office holds frequency data on all fires attended by a fire and rescue service in England, categorised as primary or secondary fires.[26] However, ignition source, which includes a category for 'barbecues' (of all types), is only reported for incidents classed as primary fires. However, secondary fires may be particularly relevant for this study, because they are generally small outdoor fires, not involving people or property.[26] Fires caused by single-use barbecues invariably begin outdoors, and therefore the Home Office data will only be capturing the fires caused by single-use barbecues that are sufficiently large. Wildfire (uncontrolled vegetation fires) datasets that capture all fires regardless of size are thus of particular use to this study. A report by Natural England "The causes and prevention of wildfire on heathlands and peatlands in England"[29] reports on ignition sources for a relatively small sample set of wildfire incidents in moorland environments. The project team have used these proportions to determine approximate wildfire incidents (by frequency and burn area) caused by single-use barbecues, for both moorland and additional land category typologies, across England. This has been done using national wildfire data provided by the Forestry Commission.[30] In addition, individual datasets from councils and specific fire and rescue services that record ignition sources are also discussed.

#### Home Office data

According to the Home Office, barbecues generally (not single-use specifically) are responsible for between 0.33% and 0.94% of accidental primary fires for April 2010-March 2022<sup>7</sup>. [26] This reached a peak in 2020/2021 when 435 accidental primary fires were linked to barbecue fires (0.94% of all accidental primary fires). If referring to accidental *outdoor* primary fires only, barbecues are responsible for between 1.86% and 4.09% of incidents, with a peak in 2020/2021 with 138 fires (4.09%). This is the source of the statistic that is commonly reported in the media when attributing ignition source to *single-use* barbecues,[36] as well as being used during discussions around measures for single-use barbecues within the House of Commons.[16] As discussed, this importantly omits all secondary fires (smaller, typically outdoor fires).[26]

#### Wildfires

There have been a number of high-profile wildfire incidents thought to have been caused by barbecues. These include a very large fire in Wareham Forest in 2020, covering 220 ha,[37] and a fire in 2019 on Marsden Moor, which covered 278 ha[38] (see Section 3.1.2.3 for further details regarding the impacts of these fires).

Many stakeholders, including the National Fire Chiefs Council, the National Trust, the Moorland Association, and the National Gamekeepers Association, all informed the project team that wildfires potentially caused by single-use barbecues taking place in moorland environments<sup>8</sup> were a particular point of concern, citing – for example – the 2019 Marsden Moor fire. The fire at Win Hill in 2022[39] is an example of another major moorland wildfire thought to have been started by a single-use barbecue. As discussed, 48% of wildfire's burn area between 2009-17 took place in 'mountain, heath and bog' environments, despite just 0.9% wildfires by number occurring there.[30] The concern with wildfires potentially caused by single-use barbecues occurring in such environments is highlighted by

<sup>7</sup> These databases are reported annually covering the financial year.

<sup>8</sup> For the purposes of this discussion, moorland is used to describe peatland environments, as well as upland heath, blanket bog, scrub, and upland grassland.

the submission of two consecutive Private Members Bills at Westminster (one in 2021, and one in 2022) both of which targeted a prohibition on barbecue use on moorland, though the second also included other areas (see Section 4.1 for further information).

According to Natural England’s 2020 report[29], out of a dataset of 3,127 reported wildfires, 382 (12% of all fires) had a specific cause identified, and of these, 39 (1.25% of all fires; 10% of those with an identified ignition source) identified barbecues as the source of ignition. This compares to 199 fires (6.4% of all fires; 49% of those with an identified ignition source) started by campfires, and 57 fires (1.8% of all fires; 15% of those with an identified ignition source) started by land management burns, making barbecues the third most prominent ignition source. It is important to note that no distinction is made between single-use barbecues, improvised (e.g., barrel barbecues) or portable barbecues.[29] Whilst quantifying such proportions is difficult for wildfire data, a National Trust employee representative for Studland Bay informed the project team that approximately 95% of all barbecue incidents relate to single-use barbecues, and the project team has used this assumption in **Table 3-2** below and in the modelling section when assessing impacts of policy measures for single-use barbecues.

Using wildfire data for the years 2009-2021 provided by the Forestry Commission[40, pp. 2020–21], the project team has extrapolated the middle-bound figure for the percentage of wildfires caused by barbecues (all types) from the limited sample dataset from Natural England’s 2020 report[29] (5.7%), to model the potential contribution of barbecues (all types) to all cases of wildfire occurring in moorland environments<sup>9</sup>, as well as for three additional land type categories. These are: ‘Woodlands’<sup>10</sup>, ‘Arable’<sup>11</sup>, and ‘Built up areas and gardens’<sup>12</sup>. Extrapolating the data is more accurate for the land category of moorland because it was in this land type that the proportion of wildfires due to barbecues (all types) were drawn from in the Natural England report[29]. Nonetheless, the same proportions have been used to extrapolate the data for the other land type categories, although these assumptions are less likely to hold true. Data has also been averaged to give numbers of wildfires and associated burn areas, per year. Additionally, the wildfire figures calculated to be caused by barbecues (all types) were reduced by 5% to estimate the number caused by *single-use barbecues only*. This data is presented in **Table 3-2**.

The data for the average number and burn area for wildfires in England assumed to be caused by *all types of* barbecues is shown in the Appendix (Section A 4.0).

**Table 3-2: Average numbers and burn areas for *all* wildfires, and those wildfires assumed to be caused by *single-use* barbecues per year**

	Average number of wildfires per year	Average burn area of wildfires per year	Average number of wildfires caused by single-use barbecues per year	Average burn area of wildfires caused by single-use barbecues per year
All land types	44,664	9,182 ha	2,431	500 ha
Moorland	1,350	4,573 ha	73	249 ha
Woodlands	5,350	669 ha	471	36 ha
Arable	10,004	2,343 ha	544	127 ha
Built up areas and gardens	24,654	1,597 ha	1,341	86 ha

Note: these figures are rounded.

<sup>9</sup> Using the Forestry Commission’s land categories of ‘Mountain, heath and bog’ and ‘Semi-natural grassland’

<sup>10</sup> Forestry Commission land categories of ‘All NFI forest types; woodland (verified and non-verified in OSMM)’

<sup>11</sup> Forestry Commission land categories of ‘Arable’ and ‘Improved Grassland’

<sup>12</sup> Forestry Commission land categories of ‘Built-up areas and gardens’

## Fire attribution reported by stakeholders

Councils and regional Fire and Rescue Services provide more localised single-use barbecue fire related data. According to Dorset Council, in the summer of 2022,<sup>13</sup> 25 reports from 93 fires on Dorset heathlands identified barbecues or campfires being a possible cause. A total of 31 hectares of heathland was burnt during this time period.[41] Derbyshire Fire and Rescue also reported 239 barbecue related incidents between 2015 and 2022, with an average of 30 per year. The vast majority of incidents from this dataset caused small fires of between six to ten square meters. Northumberland Fire and Rescue reported eight fires attributable to single-use barbecues over the last three years.

Barbecue ‘near misses’ - fires or barbecues left unattended - were also reported by stakeholders. These have the potential to turn into serious fires but will not be recorded in fire databases. According to the National Trust, 3 out of 9 wildfires in 2022 in the Marsden Moor area were suspected to be caused by single-use barbecues, however, there were a further 12 near misses.[42]

Observing the discrepancies in the data between different stakeholders and from available datasets online points to the uncertainty associated with attributing the source of ignition to fires. The National Trust and Dorset Council, for example, report a very high attribution rate to barbecues (respectively; over 30% of fires in one moorland area, and just under 30% attributable to barbecues or campfires). This compares to the 1.86% - 4.09% figure extracted from the Office for National Statistics Data[26] for all primary fires, and the 1.25%- (lower bound) figure from Natural England’s 2020 report.[29] There are also significant differences between different fire and rescue services, with Derbyshire Fire and Rescue reporting over ten times the frequency of fires attributable to single-use barbecues per year than Northumberland Fire and Rescue, despite the regions sharing similarities in their land type composition, and Derbyshire having just three times the population.[43] Whilst there is no doubt that single-use barbecues are starting fires, such variance in values, notwithstanding the likelihood of genuine variation in prevalence, underscores the uncertainty in the data, as well as providing evidence of the range in methodologies and requisite burden of proof that different authorities and Fire and Rescue Services may be using when attributing fire ignition source.

## Bin fires

Stakeholder engagement[44], [45] informed the project team that a common issue, particularly in beachfront areas, is the inappropriate disposal of single-use barbecues in public use waste bins. This can cause the contents of the bin - which is often composed of flammable waste materials like paper and cardboard - to set fire if the single-use barbecue remains hot. Single-use barbecues can take up to 48 hours to fully cool, giving them significant time to be a cause of ignition in an environment like a waste bin.

To give some examples, in 2020, North Norfolk District Council had three bins suffer irreparable damage due to single-use barbecues being placed in them (with a total cost of replacement of £2000, and likely higher overall incident costs).[44] In 2021, Brighton and Hove City Council lost 2 bins in this manner.[46] In 2020, major UK waste company Biffa issued an alert to the British public about the dangers of putting single-use barbecues in bins, following a reported post-COVID lockdown rise as fires in collection vehicles and at waste depots due to their incorrect disposal.[47] Keep Britain Tidy (KBT) issued a survey with local authorities (see Section 3.2.1 for further detail) which found that fires caused by single-use barbecues at waste and recycling depots were a concern cited by 9% of local authorities surveyed.[3]

<sup>13</sup> From the 1<sup>st</sup> of April to the 26<sup>th</sup> of August 2022

In the case of North Norfolk DC and Brighton and Hove CC, this led to both councils installing specialist single-use barbecue bins at locations along the beachfront (see Section 4.1.1.5).

### 3.1.2.3 Severity of Incidents

Fires caused by single-use barbecues will vary significantly in the damage that they cause, in terms of their burn area, their costs to extinguish, and related damage costs. **Table** shows a summary of the impacts of three highly damaging and high-profile wildfires which were likely started by single-use barbecues.

**Table 3-3: Examples of highly damaging wildfires caused by single-use barbecues**

Date	Location of fire	Area covered (ha)	Number of firefighters /fire engines involved	Cost (£)	Cost description
2020	Wareham Forest[37]	220	250 firefighters	570,000	Total direct additional costs
2022	Win Hill[39]	1	34 fire engines	250,000	
2019	Marsden Moor[38]	278	100 firefighters	500,000	Damages requiring repair

#### Wildfires in moorland

Wildfires in heathlands and peatlands are an additional point of concern because they are remote landscapes. This exacerbates the difficulties and associated costs when responding to these types of fires. It can be hard to access many parts of the moors, meaning that specific all-terrain vehicles are required.[48] Stakeholder engagement (National Trust) informed the project team that there is also significant variation in the capacities of various fire and rescue services to adequately respond to such fires. In addition, when peat begins to burn, it is also particularly difficult to extinguish as well as creating particular smoke hazards for responders.[49]

These regions are also important because peatland is a vast store of carbon; England’s peatlands currently store 580 million tonnes of carbon.[50] Burning directly releases carbon into the atmosphere and contributes to climate change. Other pathways for carbon loss are triggered by the erosion of burnt soil.[31] If this were all to be lost to the atmosphere, it would be equivalent to 2.14 billion tonnes of CO<sub>2</sub>, which is around five years of England’s total annual CO<sub>2</sub> emissions.[50] They are also important because they support the diversity of otherwise scarce and increasingly rare species, supporting habitats that are notable in England for tending to be unfragmented. 70% of the UK’s drinking water is also sourced from mountain, moor and heathland environments; if elements of these environments are damaged through fire – for example, if an area of peatland were to be burnt out – natural water filtration capacity locally could be reduced.[51]

#### Underground fires

One of the notable associated risks of wildfires is what is known as ‘underground fires’. The Director of Holkham Nature Reserve, as well as the National Fire Chiefs Council, reported that fires may go underground and smoulder the soil (or peat), only to reappear later. This form of combustion typically takes place at much lower temperatures than flaming combustion (500 °C to 700 °C versus 1500 °C to 1800 °C) [52]. Smouldering is chiefly the type of combustion found in duff peat, and muck, and characterises fires found in ecosystems in which these soils or fuel



types dominate during dry conditions. When underground fires do become established, they are notoriously difficult to control or extinguish.[52] At present, there is no evidence to suggest that single-use barbecues are more or less likely to cause such types of fire.

### 3.1.3 Sky Lanterns

Sky lanterns also have the potential to be the ignition source for fires. This section outlines how sky lanterns may cause a fire as well as data that has been found through research and stakeholder engagement on the number of fires caused by sky lanterns and the severity of these incidents. Overlap with discussion in the preceding section is avoided, but this section is also shorter as the evidence is weaker than for barbecues.

#### 3.1.3.1 Introduction to fire risk

Stakeholders, and the National Farmers' Union (NFU) in particular, reported being concerned with the fire risk from sky lanterns because of the total lack of control over the item once released. Theoretically, sky lanterns should only fall to the ground once the fuel source is used up whilst airborne and should therefore only fall to the ground once extinguished. Nonetheless, this is not always the case, and sky lanterns may fall to the ground with the fuel source still burning and potentially lighting the ground. The paper of the sky lantern may also set light and act as the primary ignition source. Product design changes can reduce sky lantern fire risk, and these are discussed in Section 4.2.1.

The difficulties associated with attributing ignition source to sky lanterns are exacerbated by the nature of the item; a sky lantern will be completely incinerated by any fire (save for, in the case of sky lanterns with a metal wire frame, a small amount of metal wire being left), whereas a single-use barbecue can survive very high temperatures. Therefore, whilst sky lanterns do not suffer from survival bias like single-use barbecues, traceability of the item is much more difficult. In theory, survival bias (a problem for barbecues) may lead to an over-reporting of incidents, whereas perishable items like sky lanterns could be associated with underreporting. For sky lanterns, it is difficult to see how ignition cause could be determined outside of reported sightings or video recordings of the fire being started.

#### 3.1.3.2 Number of incidents and incident severities

There is relatively little data on the total number of fire related incidents from sky lanterns. In addition to problems with identifying ignition cause, one consideration is that sky lanterns may be more likely to be released during winter months, when fire risk is lowest, in an inverse of fire risk associated with single-use barbecues. The sales period around Christmas and New Year is particularly busy,[20] and Chinese New Year and Divali also take place during the winter months. The days are also shorter in winter, and sky lanterns are more visible, and thus more likely to be used, at night.

The Defra 2013 report provided a sky lantern fire risk incident summary up until that date, reporting that a study in 2011 by the Chief Fire Officer's Association (CFOA) found that there were 121 fire incidents reported by 26 Fire and Rescue Services over a 2-year period (approximately 2.5 incidents reported per service annually). A number of cases of fires thought to be caused by sky lanterns were also reported, including two in Oxfordshire in 2009 and 2010 setting light to 10ha of cereals and 7ha of barley respectively.

Derbyshire Fire and Rescue reported five sky lantern incidents between 2015-2022[53], all with small burn areas of less than 20m<sup>2</sup>. In Natural England's 2020 report[29], one fire out of 382 wildfires (3,127 in the entire dataset) where a specific cause was identified was attributed to a 'Chinese Lantern'.

Nonetheless, there is also the potential for isolated incidences involving sky lanterns causing extremely damaging fires. Two of the most high-profile sky lantern incidents in Europe are not wildfire related but have occurred to buildings. In each case, the fire was started due to the sky lantern's ability to float into, or onto, hard to access locations. The first occurred in the UK in 2013 at a Smethwick recycling plant. The sky lantern was captured on CCTV drifting over a wall and into the compound of the recycling centre, where it landed on combustible plastic material<sup>[54]</sup>. The fire was the largest ever dealt with by the West Midlands Fire Service, involving 200 firefighters, 45 fire engines and causing £6m worth of damage.<sup>[9]</sup> <sup>[55]</sup> The other major incident happened in Krefeld Zoo, Germany in 2020. It was reported that one lantern set fire to the roof of an ape house, resulting in the deaths of more than 30 animals.<sup>[10]</sup>

Therefore, fire risk from sky lanterns is difficult to assess, with limited data on incident frequency. There is also greater variability in product type than for single-use barbecues, and there are potential issues with identifying all sky lanterns under the same typology when discussing fire risk. The data which is available from available wildfire datasets and stakeholder engagement appears to show much lower incident frequencies than for single-use barbecues, with lower associated burn. Nonetheless, the few very high-profile incidents in urban areas underscore the potential devastating damage and risk to life that items classified as sky lanterns can cause due to the fire hazard they pose.

## 3.2 Litter

This section discusses litter impacts from each of the items in scope. Litter impacts are diverse, and range from reduced visual disamenity for the public, to risk of injury for people and animals (discussed in more detail under other impacts), to ingestion or choking hazard for animals (especially marine life), and microplastic pollution. Litter impacts are related to other impacts, in particular, animal welfare and ecology (see Section 3.2.4).

### 3.2.1 Single-Use Barbecues

Some of the best time series data on litter arising by item type comes from marine litter monitoring. While the current study is focused on terrestrial and marine impacts, the marine data is nonetheless a good place to start, especially when it comes to exploring trends.

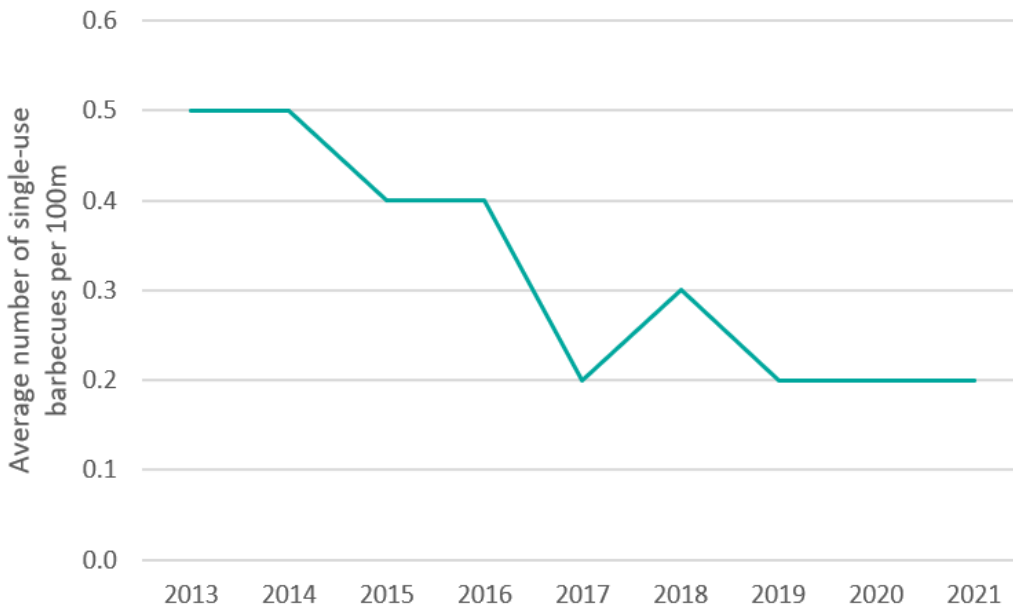
#### Evidence from marine litter data

OSPAR, the mechanism by which 15 Governments<sup>14</sup> and the EU cooperate to protect the marine environment of the North-East Atlantic, provides guidelines and generates data on marine litter according to a standardised methodology.<sup>[56]</sup> The Marine Conservation Society (MCS) collects beach cleaning data for the UK, reported through its Beachwatch database, which records the average number of items collected per 100m of the beach. **Figure 3-1** shows the number of littered single-use barbecues per 100m according to MCS data<sup>[2]</sup> and **Figure 3-2** shows the number of single-use barbecues as a percentage of overall beach litter by year according to OSPAR data<sup>[1]</sup>. According to this data, the average number of single-use barbecues found on a 100m stretch of beach in the UK is between 0.2 – 0.5 items and single-use barbecues represent 0.001-0.020% of beach litter by number of items.<sup>15</sup> The graphs show that the litter prevalence of single-use barbecues has been declining. When looking at the data, one should however be mindful that single-use barbecues tend to be buried in a thin layer of sand or pebbles when left

<sup>14</sup> These governments are; Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

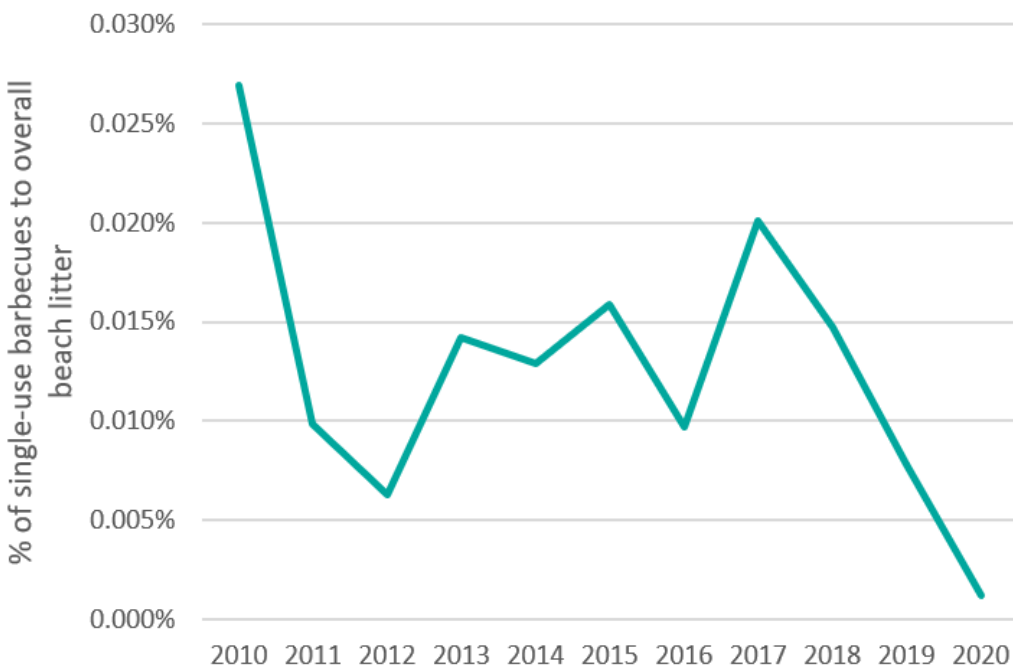
on, or washed up on, beaches (see Section 3.2.5), so true incidences of litter may be higher. The data here, available for 2020 and 2021, however, does not appear to align with dramatic increases in sales reported by manufacturers (see Section 2.3.1). It may be that collection of data was hampered during these years, and in addition, during lockdowns, people’s movement and opportunities for socialising on beaches would have been restricted, so sales could reflect increasing usage at home in people’s gardens, or in other permitted but localised locations. The data also does not incorporate 2022, which saw a dramatic increase in use according to some stakeholders. The litter frequency reported by stakeholders is discussed below.

**Figure 3-1: Average number of single-use barbecues found per 100m, MCS**



Source: MCS (2022) Beachwatch data

**Figure 3-2: Percentage of disposable barbecues as beach litter by year, OSPAR**



Source: OSPAR (2020) Beach Litter Database

## Evidence from stakeholder engagement

The project team engaged Brighton and Hove City Council, and Holkham Nature Reserve as part of stakeholder engagement – both locations with high visitor numbers and space where barbecue use is likely. Both have also taken action to try to manage risk in relation to these items. This section considers how these two cases are supported by wider evidence.

Brighton and Hove City Council reported that post-COVID lockdowns, there were substantial increases in footfall on beaches and public spaces and associated increases in littering, including of single-use barbecues. For Brighton and Hove City Council, these increases were a significant motivation for holding a public consultation on the item and the subsequent implementation of a Public Spaces Protection Order (PSPO) prohibiting the use of the item on beaches and public spaces (see Sections 4.1.1.3 and 5.1).

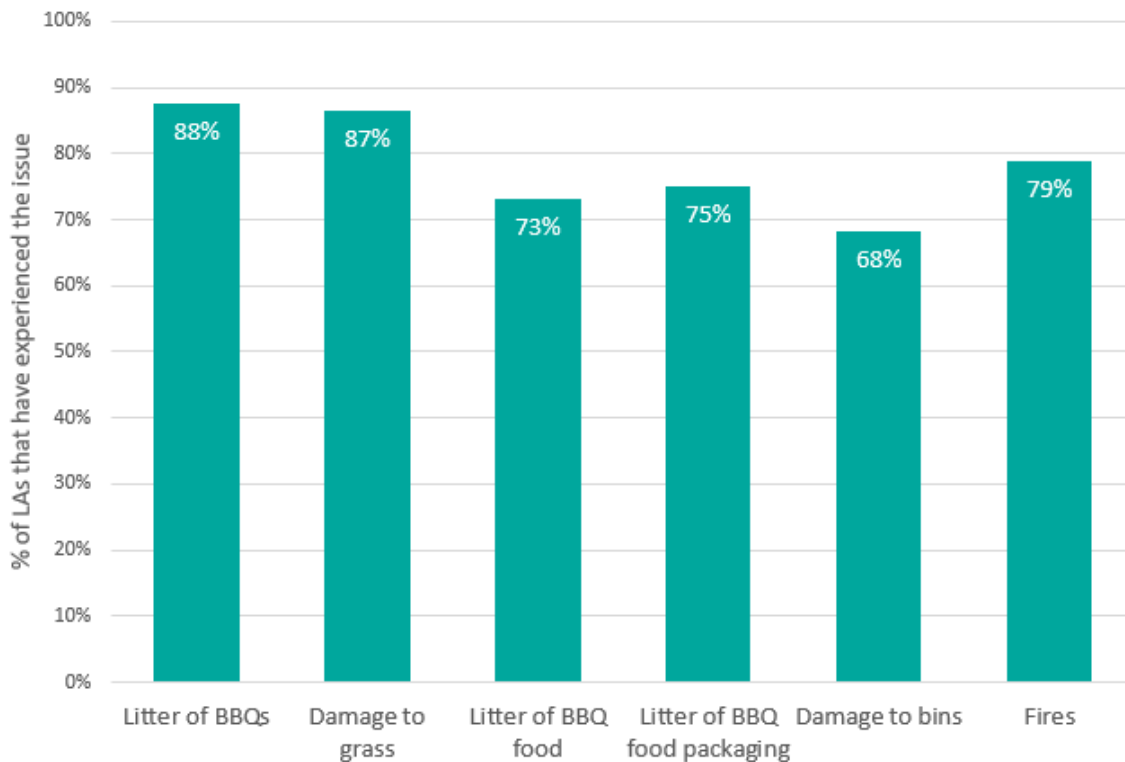
The Director of Holkham Nature Reserve also reported a post-COVID spike in incidences of littered single-use barbecues, with particularly high incidences in 2022. Holkham not only receives high visitor footfall and incorporates a long stretch of coastline, but also incorporates large areas of woodland and grassland (which are more at risk to fire than beach land). Holkham reported an approximate 200% increase in incidences of single-use barbecues left littered in 2022 than in previous years, with “a dozen” found over a summer weekend being common in 2022.

An issue particular to the item is that they are too hot after use for individuals to carry them away by hand to dispose of or take home. Carrying one away in a bag is also unlikely (and potentially unsafe) because the temperatures can melt or burn bags. The Moorland Association informed the project team that clearing up the litter from single-use barbecues is particularly important, because otherwise, it results in increased incidences of the item being littered, as people form an impression that this is acceptable behaviour.

Keep Britain Tidy (KBT) also informed the project team that they are concerned by the increasing prevalence of ‘biodegradable models’ of single-use barbecues with bamboo grills, as these may make people believe that it is acceptable to leave the item behind rather than dispose of items responsibly.

In October 2022, KBT sent out a questionnaire to a range of local authorities through their Local Authority Network. The survey focused on the issues that local authorities face due to single-use barbecues and the preventative measures they are taking (see Section 4.1.1). The littering of single-use barbecues was the most commonly cited issue (88%) by local authorities in KBT’s survey. Since barbecues are cooked on with packaged food, issues with the littering of the food itself and its packaging are also prominent issues. Associated with the issue of littering is that of burnt grass, often from where hot coals are tipped out onto the ground, or where the barbecue has been allowed to sit on a bed of grass when in use (87%). A high-level summary of the most prominent issues cited by local authorities is represented in **Figure 3-3**. The category of fires collates responses to three separate issues (Fire – grass (48%); Fire – woodlands (23%); Fire – waste/recycling depot (9%)).

**Figure 3-3: Issues caused by single-use barbecues, as perceived by local authorities[3]**



Source: Keep Britain Tidy ‘Disposable BBQ survey with local authorities’ (2022)

### 3.2.2 Sky Lanterns

Definite information on the amount of litter produced by the release of sky lanterns is lacking. Nonetheless, because all releases must inevitably return to the ground – potentially a considerable distance from where they are released – it is assumed that all releases will ultimately end up as litter, and therefore that approximately 1.9 million (based on market size estimates – see Section 2.3.2) sky lanterns end up as items of litter every year in England. In practice, given England’s geography, some are likely to end up in the sea, but this is also clearly not a desirable outcome from an environmental point of view.

It is important to note that a figure which is often circulated online is that just 200,000 sky lanterns are released each year. This is mentioned in the National Farmers’ Union’s (NFU) campaign to ban the item,[13] as well as the Royal Society for the Prevention of Cruelty to Animals’ (RSPCA) online briefing document for the item, published in 2015.[57] However, this number does not appear to have originally been related to an all-England, all-year estimate. In 2010, the Women’s Food and Farming Union (WFU), an organisation no longer in existence, reported that they were anticipating 200,000 sky lanterns would be released *that summer*, in an article for BBC News.[58] Based on engagement with a prominent UK sky lantern retailer, it is understood that the holiday season in winter is the most popular time for sky lantern use. Christmas, New Year, Chinese New Year and Divali are more likely occasions for sky lantern use in themselves, and sky lanterns are primarily designed as a night-time object, and earlier evenings and longer winter nights may well be more conducive to use. Therefore, the current study has assumed sales data is a more likely indicator of use, and eventual resulting litter – an assumption that implies far higher littering levels than the commonly quoted “200,000” figure.

The National Gamekeepers Organisation informed the project team that, prior to the implementation of a Public Spaces Protection Order (PSPO) banning their release within the High Peak region of the Peak District National Park in 2021, gamekeepers would typically retrieve 300 sky lanterns every year. Given that approximately a fifth of the Peak District is made up of grouse moor,<sup>[59]</sup> this means that approximately one sky lantern was found for every square kilometre of grouse moorland every year in the Peak District (total area of Peak District NP is 1,437 square kilometres). Given that the actual retrieval rate will likely be significantly less than one hundred percent for those that are littered, the true figure is likely to be substantially higher.

### 3.2.3 Helium Balloons

Unlike sky lanterns, not all helium balloons used will end up as litter. Helium balloons can be used inside or kept tethered outside, in which case responsible disposal is possible.

#### Behaviour of balloons and the nature of balloon litter

Although balloons are released as a single item, there is conflicting evidence in the literature about what happens to a helium balloon after it is released into the air. In 1989, a study was carried out by the technical director of the National Association of Balloon Artists and Suppliers (NABAS), DK Burchette, to test the fate of helium balloons under different environmental conditions. This study concluded that when a balloon reaches an altitude of 5 nautical miles, it will fracture into tiny fragments. It was also determined that 90% of balloons reach this altitude, meaning that just 10% are littered on land or water as *visible* items.<sup>[60]</sup> This is commonly reported by organisations, notably including those opposed to balloon releases, like the Marine Conservation Society.<sup>[61]</sup> However, Burchette's paper has been subject to critique for its methodology by Keep Wales Tidy (KWT).<sup>[11]</sup> Indeed, a subsequent paper by Irwin<sup>[62]</sup> found that 81% of balloons return to earth at least half intact. Whether the litter impact of an item like a balloon is considered higher or lower if it is intact or fragmented is ultimately a value judgement and neither outcome is desirable.

Plastic and micro-plastic pollution concerns have risen significantly in recent years. Burchette's paper argued that the rate of latex biodegradation is approximately ten weeks, however, Irwin contested his findings when applied to water, with an approximate time of 5 months. Anecdotal evidence suggests degradation can take longer in real-world conditions, and latex balloons may have additional chemical additives or treatment that impacts this further. In any event, in the interim, these items pose an ingestion risk for wildlife and farm animals. Foil balloons are not biodegradable. For those foil balloons that do fracture into many micro-size pieces, these small pieces of metal will also be environmental contaminants.

#### Litter quantities

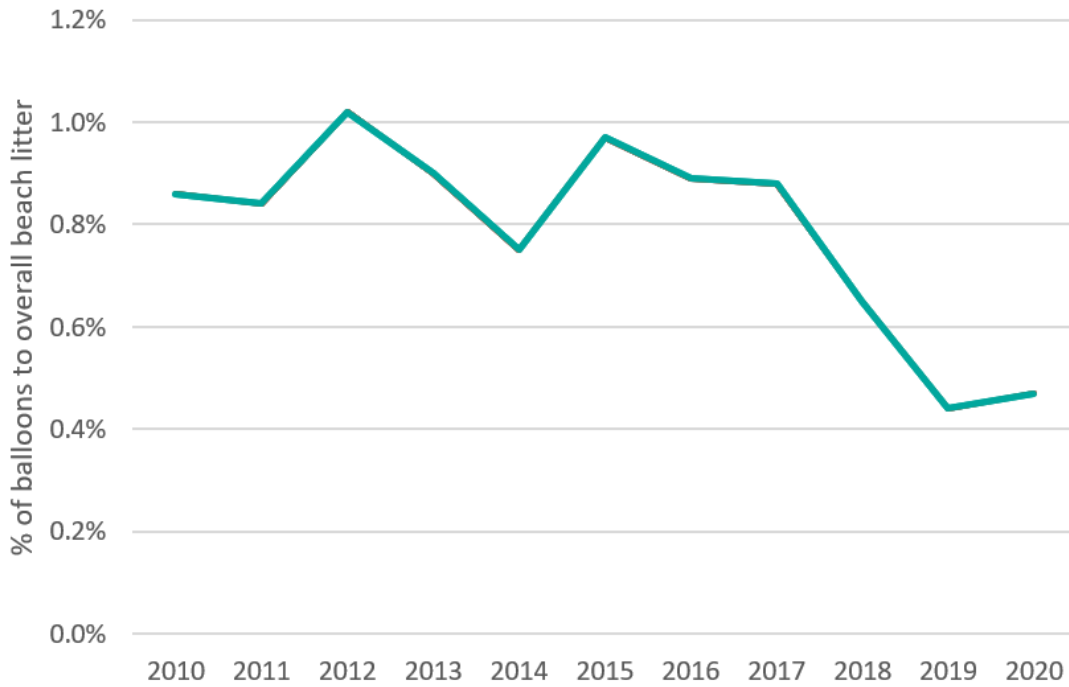
Available data appears to show that balloon litter is becoming less prevalent. **Figure** shows the decline in balloon beach litter from 2010-2020 using OSPAR<sup>16</sup> data<sup>[1]</sup> (European dataset), with balloons representing 0.4-1.0% of beach litter by the number of items, with a peak in 2012 and a noticeable reduction from 2017. This is also shown in **Figure 3-5** using MCS data<sup>[2]</sup>, where the average number of balloons found on a 100m stretch of beach in the UK was between 1 – 5, with a peak in 2016 and a subsequent and steady reduction in litter.

According to the European Balloon and Party Council (EBPC), the 40% decline in balloon litter from 2017 is due in large part to the work that EBPC did to discourage and stop the mass release of balloons through work with its

<sup>16</sup> OSPAR is a cooperation mechanism between the EU and 15 Governments to protect the North-East Atlantic marine environment. The name originates from the Oslo and Paris Conventions, using the first parts of both cities' names.

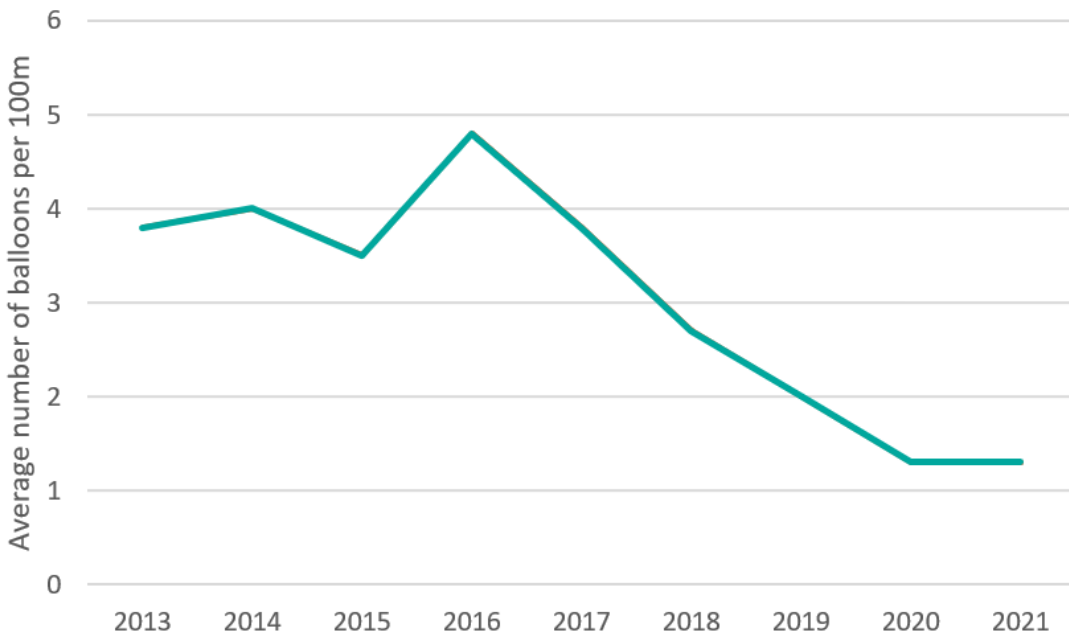
members (see Section 4.2.1.2). Reported falls in the use of helium in balloons due to cost factors are also likely to have reduced deliberate and accidental release.

**Figure 3-4: Percentage of balloons as beach litter by year, OSPAR**



Source: OSPAR (2020) Beach Litter Database

**Figure 3-5: Average number of balloons found per 100m, MCS**



Source: MCS (2022) Beachwatch data

## Other impacts

While fire risk and litter impacts were the most common risks initially identified for this study, the earlier 2013 Defra study also highlighted a range of other concerns for helium balloons and sky lanterns, while risks from litter pollution to wildlife are better understood now than a decade ago. This study also identified specific risks of injury to humans from barbecues in particular.

### 3.2.4 Animal Welfare and Ecology

This section outlines risks associated with each item in turn.

#### 3.2.4.1 Single-use barbecues

No evidence of damage to livestock was identified in relation to single-use barbecues, perhaps reflecting their most common use locations. However, other forms of harm to wildlife are likely, although not readily quantifiable in the available evidence.

##### **Pets burnt on grills or hot sand**

The outcome of the public consultation on a ban on single-use barbecues in Southend-on-Sea found that a safety concern associated with single-use barbecues left littered and buried under sand on beaches can be people's pets burning their paws on the grill or heated sand.[63] This risk exists in addition to the human health risk associated with people burning themselves (see Section 3.2.5.1). Feasibly, wildlife (e.g., foxes) looking for scraps of (littered) food once humans have left, could also expose themselves to such hazards. No quantitative data exists for such cases.

##### **Wildlife in burn areas**

The loss of wildlife, as well as habitat, following a major wildfire, is significant, although again very difficult to quantify and the extent of loss is also dependant on the type of area burnt. Moorlands, for example, can be important species rich habitats for mice, voles, butterflies, lizards and adders, as well as a variety of birds like grouse, skylarks and snipe which nest, breed or feed there.[64] The National Trust's Initial Impact Report of the 2021 fire on Marsden Moor reported examples of burned nests as well as the burnt remains of invertebrates, amphibians and small mammals found during walkover surveys.[38] Nonetheless, evidence also found of continued nesting following the fire, from a variety of bird species,[38] is a reminder that fire is to an extent a natural part of most ecosystems, and the capacity exists to recover. Nonetheless, the unnaturally high frequency of fires or the size of burn areas may still be problematic, especially in the context of already fragile or more degraded habitats like peat moors.

#### 3.2.4.2 Sky lanterns

Perhaps associated with a declining use of sky lanterns, as well as a reduced media interest in the item, the project team did not find a large amount of new evidence relating to increases in impacts on animal health. The Defra 2013 report[11] highlighted two potential impacts for animals due to sky lanterns. Firstly, injury or fatality via ingestion of the metal wire or other component material (e.g., bamboo shrapnel) used to maintain the structural integrity of the lantern whilst airborne, and secondly, potentially 'spooking' animals whilst the lantern is in flight.



## Animal injury

The Defra 2013 report described the potential consequences of sky lantern ingestion, including: penetration of the reticular/rumen wall, penetration of the heart, initiation of infection within the chest cavity, rupture of an abdominal blood vessel and development of chronic localised peritonitis, causing further chronic digestive problems. The report gave two incidents of injuries sustained to horses due to ingestion of sky lantern wire, over a three-year period. Project team correspondence with the British Horse Society (BHS) found that between the years of 2010-2021<sup>17</sup>, there were three fatalities and six injuries, meaning that there had been a further four injuries and three fatalities since 2013. The BHS also informed the project team that it estimates that one in ten incidents are reported, so the true figure could be in the order of magnitude of ten times higher. Nonetheless, given that BHS members care for approximately one million horses<sup>[11]</sup>, this remains a relatively low incidence rate.

The Defra 2013 report also reported that there was a total of 16 cases of injury or death to cattle, sheep or horses which were attributed to wire from sky lanterns, with 12 of them confirmed via post-mortem between the years of 2010-2013, gleaned from press articles or personal interviews. They also reported on evidence submitted by the Women's Food and Farming Union (WFU) that there had been ten reports of associated cattle fatalities, and one sheep fatality, although the timeframe for these cases was not available. Also, according to the WFU, farmers are concerned with the metal being cut into small needles and then incorporated into hay or silage.<sup>[65]</sup> The project team found little in terms of new evidence since the publishing of the Defra 2013 report, except from a consultation held by the Isle of Man Government on sky lanterns, which reported on two incidents of cattle death due to sky lanterns from the island (timeframe also unavailable).

## Animal behaviour

In regard to the second impact, the Defra 2013 report found evidence of nine anecdotal cases of horses being spooked between 2010-2013, reported by the BHS. Project team correspondence with the BHS found that out of a total of 25 reported 'alarming' incidents between the years of 2010-2021<sup>18</sup>, 16 did not contain a reference to injury/fatality which means they were associated with 'spooking'. Again, the 'true' order of magnitude was estimated to be ten times higher, but nevertheless, this appears to be relatively inconsequential in the wider scope of the items' impacts.

## Summary

While every individual incident may be serious for the animal involved and traumatic for human owners, the overall impacts on animal behaviour appear negligible, whilst the impacts to animals through injury or death are minor in the context of the size of the wider livestock population (despite likely significant underreporting). Nonetheless, the point raised by the WFU regarding concerns with metallic sky lantern litter being chopped up and converted into silage or causing damage to farm machinery is noteworthy. With 69% of land in England being used for agriculture,<sup>[66, p. 1]</sup> it is likely that a large proportion of sky lantern litter will end up in farmer's fields. If indeed relatively low numbers of animals are being injured by sky lanterns, this may point to most animals having the sense not to ingest them.

<sup>17</sup> Reporting ceased with the onset of COVID.

<sup>18</sup> Reporting ceased with the onset of COVID.

### 3.2.4.3 Helium balloons

The main health and welfare concern associated with helium balloons is the risk of animals choking (and potentially dying), following ingestion of balloon debris.

#### Livestock and terrestrial wildlife

The Defra 2013 report found evidence of just two incidents related to helium balloons and livestock; one involving the choking of a pedigree cow, and one of the choking of a goat (although it is uncertain if the latter's death could be attributed to the balloon). The project team's research found a number of incidents scattered through media reports available online. These included two calves that died in 2015<sup>[67]</sup> and 2019<sup>[68]</sup>, as well as two sheep in 2022<sup>[69]</sup> <sup>[70]</sup> following ingestion. Notably, in 2017 in Yorkshire, a thoroughbred horse foal (worth £15,000) was found to have died following ingestion of a helium balloon that landed in its field.<sup>[71]</sup> Because there is no formal central repository for incidents and significant under-reporting, as well as the fact that the media reports of incidents are scattered and no search can be deemed conclusive, the project team is hesitant to ascribe any conclusive figure to reported numbers of injuries or fatalities to livestock due to balloon ingestion. Nonetheless, in the wake of South Derbyshire Council banning the release of helium balloons on council owned land following the death of a sheep, one farmer and councillor stated that she "does not know of any farmer who has not lost an animal by chewing a balloon".<sup>[69]</sup> Whilst this is anecdotal, such a statement is potentially revelatory of a much higher impact of balloons on livestock than previously identified by the Defra 2013 report.

There is a lack of any statistical evidence of the impact of helium balloons on terrestrial wildlife (as opposed to farm animals) and ecosystems. However, project team correspondence with the National Trust did reveal that one National Trust officer does sometimes see balloons on the ground forming small pools of water when it rains. Pollinators were described as subsequently being attracted in by the colour and drowning, further attracting small amphibians to suffer the same fate. Ingestion on the scale seen in marine environments may not occur in terrestrial animals with different feeding habits but should not be ruled out.

#### Marine wildlife

Whilst the impact on terrestrial wildlife largely relies on anecdotal evidence, the data on the impacts of balloons on marine wildlife is more robust. A study by Roman *et al*, which conducted autopsies of 557 ocean-going Fulmar birds which had ingested marine debris, found that three were definitely caused by balloon ingestion, and two were assumed to have been caused by balloon ingestion (0.9% of deaths of Fulmars which had ingested marine debris<sup>19</sup>).<sup>20</sup> However, they accounted for a small percentage of all items ingested by the birds, leading the study to include, that – *when they have been ingested* – they are 32 times more likely to cause mortality in Fulmars than other types of marine plastic. A study on Pelagic Turtles found that 30% of turtles had ingested balloons, and this represented 3.2% of all marine litter ingested by turtles.<sup>[73]</sup> The precise health impacts of the balloons on turtles are unknown, but the high proportion of balloons that were found evidences their presence in their marine environment and contradicts suggestions of rapid biodegradability rates.

It has been assumed that balloons that do fracture into microscopic pieces are not a concern as an environmental contaminant for biota, because latex is not a petrochemical based plastic, and is made from rubber, which is found

<sup>19</sup> NB. This does not mean that the remainder of the birds died from other types of marine debris, just that at the point of death they were found to contain marine debris within their bodies.

<sup>20</sup> <sup>[72]</sup>

naturally. However, as discussed earlier, it is worth noting latex in balloons may not be in a truly “natural state” (e.g., if chemical additives or heat treatments are used), and this assumption could be revisited with improved evidence.

## 3.2.5 Human Health

This section explores the number and severity of human health incidences from burns, cuts and carbon monoxide poisoning due to single-use barbecues. These are primarily assumed to arise from littered items, rather than during primary use of the item.

### 3.2.5.1 Single-use barbecues

Stakeholder consultation<sup>21</sup> and desk-based research revealed that single-use barbecues were sometimes the cause of damage to people’s health, largely via injury. The most commonly cited examples were of people stepping on single-use barbecues, often when on beaches. An issue here is that irresponsible users may sometimes cover a single-use barbecue in sand (or pebbles) as a means of ‘disposal’ and people may subsequently unwittingly step on it whilst it, or the sand covering it, is still hot. Indeed, sand, when used to smother a fire, has the ability to retain sufficient heat to cause a thermal contact burn for long periods of time.[74] Improper use of a single-use barbecue may also result in carbon monoxide poisoning. If damaged, sharp metallic edges are also a risk to users or the public when the item is littered, however, no specific data on this was uncovered in the course of this research.

#### Thermal Burns

Keep Britain Tidy’s survey amongst local authorities found that burns from single-use barbecues were an issue for 14 of those sampled (13.6%).[3]

- **Major burns:** In one study from 2012[74], a series of 296 hospital admissions for burns at a specialist paediatric burns unit in Bristol, England, were analysed. 17 patients (5.7%) had burns associated with the use of single-use barbecues and nine patients (52.9% of barbecue related burns, 3% of all admissions) sustained burns as a result of contact with the hot sand where single-use barbecues had stood. This issue tends to impact young children the most. The median age of those admitted to hospital was 4.6 years. These burns were also relatively serious, with a mean initial hospital stay of 2.3 days. [74]

The project team’s correspondence with the International Burn Injury Database (iBID) revealed that in England and Wales since 2005, there had been approximately 200 single-use barbecue related admissions to a designated burns service requiring specialist treatment, according to their database (11.7 per year). This represents approximately 7% of all barbecue-related burns admissions. As a percentage of all burn admissions, however, it represents 0.08% of all burns that require a specialist burns service in England and Wales. In both regards, this is significantly less than that reported in the study by Vermaak *et al.*’s study was of paediatric burns only; burns incidences with single-use barbecues disproportionately affect children. Gaps in the iBID’s database and under-reporting may other reasons. The average cost of ‘major burns’ (inferred to mean those requiring hospitalisation) is £168, 155[75], meaning that the estimated cost of major burns due to single-use barbecues is approximately £1.8 million per year, in England.

- **Minor burns:** Admissions to A&E for single-use barbecue related injuries which can be treated within the department on the same day are considerably more common. Whilst data is somewhat less reliable, the iBID estimates that approximately 100 individuals are admitted to A&E for such injuries *each year* in England & Wales, but again this could be an under-reporting.[76]

<sup>21</sup> E.g., North Norfolk District Council (which incorporates a coastline with substantial lengths of popular beaches), and Brighton and Hove City Council

### Non-burn related injuries

People may also injure themselves by cutting themselves on a disposed barbecue's sharp edges. The Keep Britain Tidy (KBT) survey found that this was an issue cited by 17 local authorities (16.5%), although the issue was not mentioned by other stakeholders the project team engaged with.

### Carbon monoxide poisoning

The production of carbon monoxide from disposable barbecues in an enclosed space has been known to cause serious illness and fatalities. Hazard calculations have shown that lethal concentrations of CO and CO<sub>2</sub> can be produced relatively easily and that if the enclosure had a high concentration at the time of entry, a hazardous dose could be accumulated in only a few minutes.[77] This is why single-use barbecues must only be used outside. Examples of incidents typically involve people using the barbecue in the porch of their tent when camping or inside their vehicle, to protect it from the elements, with a number of such incidents reported in the media.[78] [79] Lyness *et al* report four incidences of deaths due to CO poisoning from single-use barbecues in Northern Ireland over a two-year period.[80]

Whilst this is an important consumer related danger associated with the item, the impact of carbon monoxide poisoning has not been factored into the cost-benefit analysis for item policy interventions (see Section 6.0), since the rationale driving the study is more concerned with impacts more regularly seen as an issue by local authorities, emergency services, and land managers.

## 3.2.6 Aviation Safety

Defra's 2013 study identified the risk both sky lanterns and helium balloons, as airborne objects, could pose to aviation.

### 3.2.6.1 Sky lanterns

Sky lanterns can cause risk to aviation safety through ingestion into the engines, causing distraction to the pilot, or if remnants land on an airfield. These are referred to as Foreign Object Debris (FOD) which has the potential to damage aircraft and can cause delays due to temporary re-routing[81, p. 736]. Guidelines are provided by the Civil Aviation Authority (CAA) for minimising the risks of sky lanterns to aircraft (see Section 4.2.1.3).

The CAA has a Mandatory Occurrence Report (MOR) scheme where incidences with sky lanterns or balloons are recorded when there is interference with an aircraft. Therefore, these numbers may be a low estimate of incidences, as there may be more voluntary reports submitted directly to aerodrome operators or air traffic service providers where there is not any impact on aircraft safety[82]. Between 2012 and 2022, there were 26 MORs associated with sky lanterns, with just two since 2018. Differentiation by the nature of the MOR is shown in **Table** in the Appendix (Section A 6.0). This compares to 40 MORs reported by the CAA between the years of 2001 and 2013.[11]

The data, therefore, shows that there has been a substantial decline in MORs related to sky lanterns, despite a culture of improved reporting of such incidences. This likely reflects the decline in sales, potentially along with a halting in mass releases by event planners near airports following the CAA's issuance of guidance in 2011 and the Trade Institute's Code of Practice[7] in 2014 for the item (see Section 4.2.1.1). The Defra 2013 report concluded that sky lanterns presented a 'potential risk' to aircraft safety. Today in England, this risk appears much reduced.

### 3.2.6.2 Helium balloons

Similar to sky lanterns, helium balloons can cause issues for aviation safety through ingestion into the engine of an aircraft or by causing the pilot to have to manoeuvre to avoid a large concentration of balloons.[81, p. 736] However, although ingestion into aircraft engines is recognised as a possible outcome of contact between helium balloons and aircraft gas turbine engines, the CAA does not consider this to present a risk to safety, instead seeing manoeuvring to avoid balloons as a more credible risk.[11] Guidelines are provided by the CAA for minimising the risks of helium balloons to aircraft (see Section 4.2.1.3).

Between 2012 and 2022, there have been 146 MOR incidents related to “balloons”, with 19 of these MORs specifically referencing “helium balloons”. Just one of these balloon incidents relates to ingestion in the engine. There were also a further 114 MORs between 2015 and 2022 where the reporter was not clear if the object sighted was a drone or a balloon. This data is summarised in **Table A-5** the Appendix (Section **A 6.0**). This compares to the eight-helium balloon MORs (of which two were deemed to be out of scope for the purposes of the study since the balloons were meteorological) reported by the CAA between the years of 2000 and 2013. The CAA also stated in their correspondence that in more recent years there has been an improved culture of reporting, which could be a reason for the higher incident frequency in the past decade.

The data regarding helium balloons shows a moderate increase in incidences since 2013, potentially in part evidencing a culture of improved reporting. On the evidence presented to the project team, it is concluded that current measures to manage the release of helium balloons, as in 2013, seem to be largely effective in minimising collisions with aircraft and incursions onto airfields, despite a minor increase in numbers reported. Reduced numbers of helium balloons being released (see sales and litter information in Sections 2.3.3 and 3.2.3 respectively) may be compensated for by an improved reporting culture.

### 3.2.7 Coastal Rescue

The risks to coastal rescue services from sky lanterns arise from them being incorrectly identified as distress flares. This can trigger false callouts, diverting essential emergency resources away from real emergencies and placing emergency services personnel at unnecessary risk. This phenomenon is particularly an issue when the sky lantern is coloured red or orange which is why the Trading Institute’s Code of Practice for the item advises against the use of products this colour.[7] The cost associated with false callouts includes the time taken by the operator to answer a call, through to the deployment of lifeboats or helicopters. In 2013, costs for deploying vehicles range from £1,000 - £2,000 per hour for a lifeboat to between £7,000 and £10,000 per hour for a Search and Rescue (SAR) helicopter to be deployed (excluding manned team costs).[11]

The project team was unsuccessful in sourcing new information concerning incidences of incorrect identification of sky lanterns as distress flares. In the Defra 2013 report, incidences collated by the MCA were already substantially on the decline from a 2010 peak of 754, to 207 in 2012. Incidences may have declined in part because responders became more used to recognising the differences between sky lanterns and distress flares. For example, red distress flares typically burn for around 40 seconds, whereas sky lanterns may be visible for a much longer period. This trend is anticipated to have continued beyond 2013, following the sky lantern Code of Practice in 2014 and their declines in sales through to today (see Section 2.3.2). Together, these may be reasons for the lack of engagement and available data, since sky lanterns pose significantly less of an issue than they did at the time of the Defra 2013 report.

# 4.0 Measures and Interventions

There is currently no national policy specifically addressing any of the items that are the focus of this report. However, some existing national powers for local authorities can be specifically deployed to address some of the risks and issues presented by these items. Additionally, other landowners can attempt to impose controls, and private sector actors have taken unilateral or collective action in some cases, ranging from the provision of guidance to ceasing sales. NGOs can also seek to influence both public and business behaviour.

## 4.1 Single-Use Barbecues

### 4.1.1 Existing Measures and Interventions

This section explores measures and interventions that have been established by retailers, local authorities, land managers, and barbecue manufacturers, to mitigate the risks of environmental and human harm from single-use barbecues. For barbecues, most of the evidence is UK-based reflecting the nature of the evidence findings.

#### 4.1.1.1 Retailers unilaterally stopping sales

In the summer of 2022, some prominent retailers introduced a halt on sales of single-use barbecues because of the concerns being raised about the potential fire risk associated with their improper use. The summer of 2022 was also the joint hottest summer on record and the driest since 1976<sup>[83]</sup>. These retailers included Morrisons, Asda, Lidl, Tesco, Sainsbury's, Aldi, Waitrose, Marks & Spencer<sup>[84]</sup>, and the Co-op.<sup>[85]</sup>

Some of these retailers, like Tesco, first introduced a policy of localised halts on sales near Areas of Outstanding Natural Beauty (AONB) or national parks, before progressing to a nationwide policy.

The national halts on sales appear to be temporary, and it is unknown what policies will be in place in 2023.

#### 4.1.1.2 Local agreements to stop retail sales

This measure is related to the first but refers specifically to organisations with jurisdiction over land that is subject to fire risk (generally national parks or environmental areas popular with visitors) working with local retailers to implement a localised halt on sales.

For example, Holkham Nature Reserve, in Norfolk, advised local retailers, including a supermarket, to stop sales of single-use barbecues locally. The Director of the Reserve informed the project team of the importance of starting such campaigns early in the season, prior to when fire risk is at its maximum. However, they also informed the project team that this intervention's effect is limited by the fact that many visitors to the Reserve arrive from "hundreds of miles away".

In the summer of 2022, New Forest National Park also worked with retailers in and around the New Forest, resulting in 50 retailers introducing halts on the selling of single-use barbecues. According to the New Forest National Park, this action, along with the introduction of a Public Spaces Protection Order (PSPO) banning their use (see Section 4.1.1.3) was associated with a 40% reduction in fires from 2020, and a 30% reduction from 2019 levels.<sup>[86]</sup> However, it cannot be proven that the intervention and a corollary reduction in fire incidents was due wholly or in

part to the intervention. The Moorland Association has also worked with retailers that border moorland and national parks to halt sales, but according to the representative that the project team spoke to, this has “not stopped people arriving with them.”[87] Keep Britain Tidy’s survey with local authorities found that 7% of local authorities surveyed had implemented this intervention.

### 4.1.1.3 Local bans and restrictions on use

A range of tools that can restrict use on public and open access land already exist<sup>2223</sup> and can be deployed at local levels. These include powers to regulate or prohibit the lighting of fires (including barbecues) on Access Land in Areas of Outstanding Natural Beauty (AONBs) and National Parks, as well as “Bylaw” legislation which enables local authorities to restrict the use of disposable barbecues in parks and public spaces.

An additional step local authorities can take to implement an effective ban on the use of single-use barbecues on public land is via the use of a Public Spaces Protection Order (PSPO)[88]. The Keep Britain Tidy (KBT) survey with local authorities found that 23% of local authorities have implemented this intervention. Under a PSPO, a fixed penalty notice (FPN) of £100 can be issued to an offender.[88] PSPOs can be implemented if activities carried on in a public place have had a detrimental effect on the quality of life of those in the locality. PSPOs would normally be seen as an additional control step following on from the measures described above. However, they were a feature of the stakeholder communications in this research, suggesting either a perceived need for further action, or that implementing and communicating a PSPO is seen as having a potentially greater behaviour change impact.

A few select examples of PSPOs include Brighton and Hove City Council (all public areas), Southend-on-sea City Council (within a specified zone along the seafront and adjoining areas), Richmond Borough Council (all parks and public spaces), New Forest District Council (out for consultation), Dorset County Council (locations covering forest, heathland, and coast), High Peak Borough Council (Peak District NP) and Calderdale Council (Calderdale Moor). These examples highlight existing concerns with the use of single-use barbecues amongst a variety of settings and landscapes (beaches and coast; city parks; forest and heathland; and open moorland). Nonetheless, there is substantial variation between different landowners and organisational bodies in regard to the level of perceived risk, the importance ascribed to impacts, and what risk or evidence is deemed sufficient to implement a PSPO. For example, Derbyshire County Council (which incorporates most of the Peak District NP) has decided *not* to implement a *county-wide* PSPO for single-use barbecues on moorland, citing a lack of evidence of sufficient risk (as well as a lack of funds to implement enforcement)[89], despite the oft-cited risk to moorland and heath. However, the High Peak Borough Council, within Derbyshire and incorporating much of the northern Peak District, *has* implemented a PSPO on all Peak District NP land within the council’s jurisdiction.[90] Other authorities, like Brighton and Hove City Council, have relied on a public consultation as evidence for ordering their PSPO, with litter, damage to bins, and human health/injury being more pressing issues.

Direct evidence of the effect of these interventions is limited. Direct *enforcement* is relatively limited – but may not be the best measure of *effectiveness*. Bans may change behaviour irrespective of the extent of enforcement (provided there is sufficient public awareness of the ban) as many people will want to genuinely do the right thing or be strongly influenced by the social norms that they see around them. The mere prospect of enforcement may additionally deter some potential rule-breakers, though a deterrent effect of this kind is heavily dependent on the perceived likelihood of being caught. This might be considered higher for illegal use of a single-use barbecue (which

<sup>22</sup> Countryside and Rights of Way Act (2000) – open access land

<sup>23</sup> Wildlife and Countryside Act 1981 - Site of Special Scientific Interest (SSSI) land

takes some time) than for an instant action like littering, but nonetheless, in many locations, potential rule-breakers may see the risk of being caught as very low.

In light of the above, the descriptions of enforcement actions taken here should not be seen as the only way to assess the impact of a legal ban, though it may reflect the extent to which enforcement is providing either a deterrent or educational effect to the public. Brighton and Hove City Council reported that, since the implementation of the PSPO going live on 1<sup>st</sup> July 2022, 36 fixed penalty notices had been issued by environmental enforcement officers (as of 25<sup>th</sup> November 2022).[45] The Moorland Association informed the project team that enforcement is made difficult by the fact that people often seek privacy for their picnic and “like to hide away”, making the monitoring of trouble spots more difficult. Funding regular enforcement activities can also be a challenge for Councils, as reported by both Dorset[41] and Derbyshire[89] County Councils. This may indicate that PSPOs are best implemented by local governments within more tightly focused geographies. Enforcement may be more of a challenge within jurisdictions of large expanses of land like moorland than it is in more tightly bounded areas like beaches, or urban parks. While the discussion of enforcement focused on PSPOs, similar challenges are likely to occur in relation to other control measures highlighted in this section.

### **Information campaigns and signage**

Both information campaigns and signage can be related to the previous measure, legally enforced local bans, since both are important in notifying the public of the measure so that a ban actually prevents behaviour. Signage may also be used when there is little realistic prospect of enforcement, as they will still encourage the public to act responsibly. Regardless of whether a “ban” is in place, best practice advice would be to seek a landowner’s permission before having a fire or barbecue, which they are under no obligation to grant (see the Countryside Code[91]). There is therefore potentially some similarity in the legal and advisory approaches to bans in practice in the UK at present, though this may not be understood by all users. The public may also not fully understand that barbecue use will often be covered by restrictions on fires.

The Keep Britain Tidy (KBT) survey with local authorities found that 64% of local authorities had implemented signage to discourage the use of single-use barbecues, making it the most common intervention implemented by local authorities. However, the National Gamekeepers Organisation reported that “most people tend to ignore signage”[48], whilst the Director of Holkham Nature Reserve reported that most people also tend not to listen to signs and that it was more important to raise awareness “off-site”.[92]

### **Public facing campaigns**

Behavior change campaigns to educate the public on the safe and proper use and disposal of single-use barbecues can be rolled out on local, regional, or potentially national scales, using a variety of methodologies and platforms. For example, the British Mountaineering Council, noting the popularity of single-use barbecues amongst campers and outdoor enthusiasts, has initiated the campaign ‘No Moor BBQ’, encouraging their members not to use them in moorland environments, whilst simultaneously campaigning to make the use of single-use barbecues on a moorland a criminal offence with severe penalties.[93] In 2022, Dorset and Wiltshire Fire and Rescue also began the campaign #BringAPicnicNotABBQ.[94] A variety of councils, such as Dorset County Council, have also run public-facing campaigns, as have organisations like the Moorland Association.

#### **4.1.1.4 Consumer product labelling**

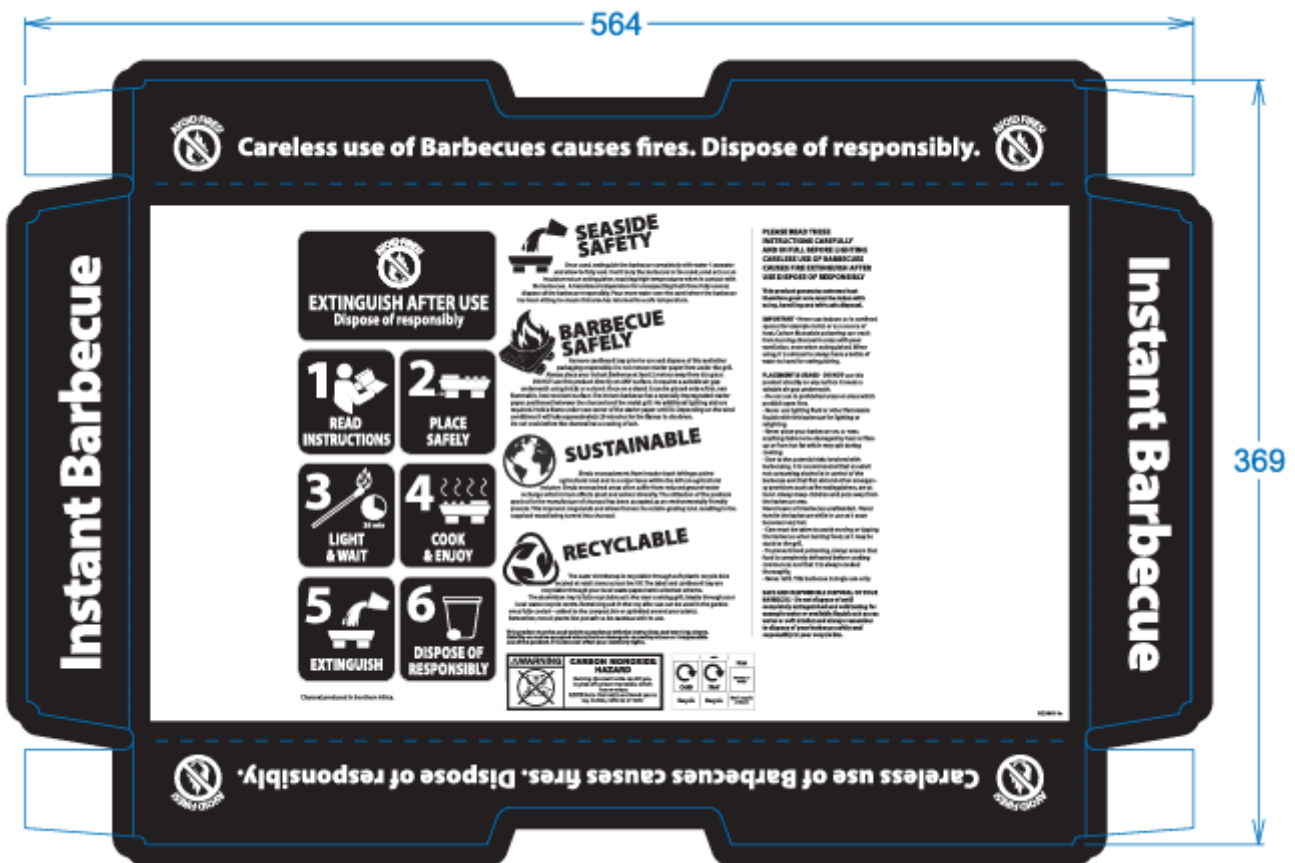
In the context of General Safety and Performance Requirements (GSPR) for single-use barbecues, mandatory labelling for responsible use does not exist, but manufacturers may choose to apply labelling on responsible use and



disposal. The British Standards Institute’s (BSI) Standard BS EN 1860: Part IV[95] is a document outlining specific guidance for disposable barbecue manufacturers, including instructions for safe use, although – again – compliance is not a legal requirement.

Single-use barbecue manufacturer *Rectella* uses a variety of labels on front-of-pack, on the back of labels, on the collar of the barbecue, as well as on the starter paper. These labels include ‘seaside safety’, ‘barbecue safely’, a carbon monoxide warning, as well as step-by-step instructions for extinguishing after use and responsible disposal, and an illustration is included below, to demonstrate the relative prominence of fire safety and disposal information in this case.[18]

Figure 4-1: Rectella’s ‘On collar’ safety labelling and instructions for a single-use barbecue



In 2021, The Co-op also launched a “hard hitting” safety drive for single-use barbecues with its ‘Put Me Out’ campaign that includes a large label of the same name on front-of-pack, as well as additional smaller safety labelling, and a six-step safety instruction list on the base. This includes such instructions as correct barbecue placement, how to extinguish the barbecue with water following use, and responsible disposal.[96][97]

#### 4.1.1.5 Specialist bins for single-use barbecues

Some local authorities have installed single-use barbecue bins at particular visitor hot-spot locations, specifically seeking to avoid damage to normal litter bins from the disposal of hot items.

The Keep Britain Tidy (KBT) survey with local authorities found that 12% of local authorities responding had implemented this intervention. The project team engaged with two councils that have implemented this intervention; Brighton and Hove City Council, and North Norfolk District Council. Since Brighton and Hove City Council's introduction of the Public Spaces Protection Order (PSPO) for beach areas and public spaces, these bins have become less relevant.

North Norfolk District Council reported that, since the installation of 10 bins at six beaches in the summer of 2022, there had been no more incidents of bin fires (compared to three in 2021) and this had been seen as a very successful local intervention by locals and councillors. However, Brighton and Hove City Council reported that prior to the introduction of the PSPO, people were still using standardised public waste bins for single-use barbecues despite having the specialist bins in place. One reason may have been that people found them less easy to deposit coals in due to their design.

#### 4.1.1.6 Designated areas for the use of single-use barbecues

Another intervention that some local authorities have implemented is the provision of designated areas for the use of single-use barbecues and/or the provision of permanent public barbecues as an alternative to single-use barbecues, for the public to use. In KBT's survey with local authorities, 13% of local authorities had implemented one of these measures. No stakeholder that the project team engaged with could confirm an impact from the effects of these interventions. Designated areas for barbecues or firepits are a common feature in "outdoor areas" in some European countries (e.g., Scandinavia, the Swiss Alps), but no information was found specific on impacts, and these have arguably evolved alongside different cultural traditions to those seen in the UK.

### 4.1.2 Currently Proposed Measures and Interventions

The following additional ideas are currently under consideration in the UK.

#### 4.1.2.1 Voluntary guidelines

At present, the British Retail Consortium is in the process of gathering together major retailers and manufacturers of single-use barbecues, in order to produce a unified set of voluntary guidelines<sup>24</sup> for retailers and manufacturers to abide by. It is likely that the guidance will be published before March 2023, well before the commencement of the key season for selling single-use barbecues. The guidance will likely cover two major themes:

- **On pack messaging** advising around the safe use and disposal of single-use barbecues, using best practice examples.
- **A standardised set of practices for retailers** to adopt when fire risk in a specific area reaches a certain threshold level (to be developed in consultation with the National Fire Chief's Council).

#### 4.1.2.2 'Disposable Barbecue' Bills

Two Private Member's Bills have been introduced at Westminster in recent years seeking to restrict single-use barbecues,

- In November 2021, Robert Langan, MP for High Peak in Derbyshire introduced a Private Member's Bill entitled the 'Disposable Barbecue Bill' which proposed that disposable<sup>25</sup> barbecues should be prohibited on open moorland and that local authorities be given the power to prohibit the sale of disposable barbecues in their area.

<sup>24</sup> At present a more formal "code of practice" is out of scope for this group.

<sup>25</sup> The Bill used the term 'disposable' barbecues, whereas the current report prefers the term 'single-use' but the item in question is the same.

The Bill saw its first reading on the 17<sup>th</sup> of November 2021, but did not progress to the second reading, and will make no further progress following the prorogation of the 2021-2022 parliamentary session.

- In November 2022, Selaine Saxby, MP for North Devon, introduced a new Private Members Bill with the same title ('Disposable Barbecue Bill'). This new Bill seeks a broader geographical restriction than the earlier Bill. In addition to open moorland, disposable barbecues would also be prohibited on beaches, Areas of Outstanding Natural Beauty, and other areas designated for environmental protection. The second reading of this bill is scheduled for 24<sup>th</sup> March 2023.

## 4.2 Sky Lanterns and Helium Balloons

Measures and interventions for sky lanterns and helium balloons have been combined in this section because many of their risks arise from the same action on the part of the user; uncontrolled release of the item into the air.

Measures to prevent or control their release, as well as national campaigns which have 'no release' stances for both items, are therefore discussed together to avoid repetition within the report. However, individual product changes, as well as the positioning of item trade bodies, are discussed in separate sub-sections.

### 4.2.1 Existing Measures and Interventions

This section explores measures and interventions that have been established by retailers, local authorities, land managers, or manufacturers, to mitigate the risks of environmental and human harm from these items.

#### 4.2.1.1 Industry product changes and Code of Practice (CoP) – sky lanterns

Sky lanterns vary in the types of material that they are made from. The Defra 2013 report outlined some of the product changes that have been made to increase the fire safety of sky lanterns, as well as reduce their risks to animals. These include using flame retardant materials in the construction of the canopy, and the inclusion of non-drip fuel cells.[11] A wax fuel cell is deemed more dangerous because it can drop wax which may ignite the paper lantern. This is opposed to a cotton/cloth fuel cell which does not, and which is also purported to have improved flight performance and flight longevity due to increased heat power (less chance of being swept into the ground).[20] The incorporation of a fiberglass string pre-attached to the cloth/cotton fuel cell means the fuel cell remains in place while the lantern is airborne. In models where wax cells must be attached by the user to the wire/string, there is a greater chance of the fuel cell falling from its place.

Other product changes include the use of bamboo instead of wire to provide structure to the lanterns, whilst one retailer[20] the project team spoke to stated that a wooden stick model had been introduced following concerns about animal welfare due to the ingestion of bamboo shards. Without a central coordinating trade body or representative, these product changes have not been applied universally. Indeed, according to one retailer, potentially over 80% of sky lanterns use a wax fuel cell and metal wire.

Whilst there is no trade representative for sky lanterns, the Trading Standards Institute – following the publication of the Defra 2013 report – produced an industry Code of Practice (CoP) for sky lanterns for sky lantern manufacturers and retailers.[7] This gives product specification recommendations on the size and shape of the lantern, its material construction (e.g. no metal to be used, no red/orange colour, fire retardant paper, etc), ignition source, biodegradability, as well as packaging and labelling. It also produced a safety checklist that can be filled in to check compliance. Finally, it gave recommendations for instructional labelling for safer use.

### 4.2.1.2 Trade body positioning on responsible use (helium balloons)

There are a number of prominent trade bodies representing the balloon, and helium balloon, industry, in both the UK and Europe. These include the European Balloon and Party Council (EBPC), the Balloon and Party Industry Alliance (BAPIA) and the National Association of Balloon Artists and Suppliers (NABAS). The project team engaged with both the EBPC and BAPIA for this study and both reported seeking to reduce the impact of the industry on the environment, though their positions differ significantly.

All EPBC members (balloon manufacturers) have to comply with relevant European or UK safety measures<sup>26</sup>, but most importantly, in 2017, EPBC released a position statement that they did not support the mass release of balloons and have subsequently required all members to similarly adopt this position (this also aligns with bans on release adopted by some councils and event venues). A survey amongst members in 2017 revealed that there was some resistance from members, anticipating a decline in sales, but ultimately almost all agreed. According to the EPBC, the adoption of the policy by members was a significant reason for the decline in balloon litter seen since 2017 (see Section 3.2.3). BAPIA has also released a Code of Conduct<sup>[98]</sup> that does not support the release of balloons, whether multiple or single. However, the principles of EBPC are deemed to be more impactful because it is a trade body for balloon manufacturers, whereas BAPIA principally represents the décor and events market.

In contrast, NABAS does have a Code of Conduct<sup>[99]</sup>, but it is to give guidance on how to release balloons, and therefore directly contradicts a non-release message.

### 4.2.1.3 Civilian Aviation Authority (CAA) guidance

As discussed in Section 3.2.6, sky lanterns and helium balloons pose hazards to aircraft. The CAA has therefore produced a guidance document entitled “*Operation of directed light, fireworks, toy balloons and sky lanterns within the UK*”<sup>[81]</sup>. The guidelines state that sky lanterns should not be released within 10 miles of an airfield, and that mass releases of helium balloons ‘should be restricted’ within 5 miles of an airfield.

### 4.2.1.4 Bans on release on council owned land

The Marine Conservation Society (MCS), through its ‘Don’t Let Go’ campaign, maintains a list of local authorities that have instigated a ban on the release of balloons and/or sky lanterns on council owned land.<sup>[100]</sup> This list is not comprehensive, as it does not include Brighton and Hove Council, which was confirmed to have a ban on the release of sky lanterns and helium on council owned land through stakeholder engagement.<sup>[45]</sup> The English local authorities on this list can be seen in the Appendix (Section A 5.0). In total, the MCS list contains 48 English local authorities that have instigated a ban on both sky lantern and helium balloon releases, 11 on balloons only, and seven on sky lanterns alone. The NFU also maintains a list of local authorities that have banned the release of sky lanterns on council owned land. This list is also shown in the Appendix (Section A 5.0) and contains 168 English local authorities.

The legal implications and associated enforcement of the ban are not clear. The Defra 2013 report stated that the bans implemented by the 17 local authorities at the time were voluntary since waste from balloons or sky lanterns are not classified as litter and as such, no specific legal action can be taken against releases under the Clean Neighbourhoods and Environment Act (2005) or the Environmental Protection Act (1990). Nonetheless, a council such as Wirral Borough Council states that whilst this is the case, the prohibition on releases can be enforced through the adoption of the policy that the Council has the authority to determine the required conduct of people

<sup>26</sup> For example: The Toy Safety Directive 2009/48/EC; British Standard for Toy Safety BS EN71; EU National regulations and environmental standards

using its land.[101] In 2017, MP Kerry McCarthy brought forward a question in parliament requesting the Secretary of State to make the intentional release of both helium balloons and sky lanterns an act of littering, but this was declined.<sup>27</sup> However, as of 2014, councils can make it an offence under a Public Spaces Protection Order (PSPO) and issue a fixed penalty notice (typically of £100). An example of a council implementing this measure includes Brighton and Hove City Council. For this council, to date, no fines have as yet been enforced for releases. However, as discussed in Section 4.1.1.3 on local bans on the use of single-use barbecues, bans can nonetheless be effective, even if enforcement rarely occurs.

#### 4.2.1.5 National campaigns

A number of organisations have campaigns to discourage the release of balloons and sky lanterns. As in 2013, MCS’s ‘Don’t Let Go’ campaign[15] is still the most prominent of these, providing information on its website on litter counts, information on potential impacts, as well as suggestions for alternatives to occasion marking launches. The Royal Society for the Prevention of Cruelty to Animals (RSPCA) also highlights the potential impacts of sky lanterns and balloons on animal welfare and offers suggestions for alternatives through its website.[102]

The National Farmers’ Union (NFU) is one of the most vociferous campaigners against sky lantern releases. They have instigated the petition to have them banned in England and Wales, with the petition to date attracting 96,500 signatories.[13]

#### 4.2.1.6 International examples of legislation introduced or proposed

##### Sky Lanterns

A number of countries have issued legislation banning the use and/or the sale of sky lanterns, or stringent restrictions on their use. These are listed in Table 4-1.

**Table 4-1: International bans on sky lanterns**

Country	Type of ban					
	Sale	Use	Production	Transport	Supply	Importing
Australia[103] [104]	✓				✓	
Austria[105]	✓		✓			✓
Brazil[106]	✓	✓	✓	✓		
Germany*		✓				
Malta[11]	✓	✓				
Spain[11]	✓	✓				

\* Sale/purchase permitted but use is not, except for when permission is granted by the authorities in special cases of exemption from the policy[107]

Many of these countries – for example, Austria, Malta and Spain[108] - reported that the measures adopted had been effective. Nonetheless, evidence in Austria suggests that even where there has been a ban on sales, some consumers were still buying sky lanterns from suppliers in other countries.[108]

<sup>27</sup> Nonetheless, in Wales, the release of sky lanterns or balloons is viewed as littering under the Environmental Protection Act (1990).

The following countries also are reported by secondary sources<sup>[65]</sup> <sup>[109]</sup> as having bans, although the specific type of ban cannot be verified, and further information is required. These are Argentina, Vietnam, Chile, Costa Rica and Colombia.

In addition, other countries have introduced other measures including area-specific bans, voluntary measures and engagement with importers. This is shown in **Table 4-2: International measures on sky lanterns**.

**Table 4-2: International measures on sky lanterns**

Country	Type of measure
Wales	Release of sky lanterns (and balloons) banned by all local authorities on their land and property
New Zealand	Banned in some regions through bylaws
Denmark	Cannot be sold internally, but may be imported and used
Finland	Engagement with importers resulted in one major importer ceasing sky lantern operations
Netherlands	Engaged with importers and conducted risk assessments resulting in new products conforming to certain safety standards allowed for import

The example from the Netherlands appears to be a good example of the industry working with the government to address a specific issue, with the risks from sky lanterns deemed to be substantially mitigated. Nonetheless, these changes, which occurred in 2010, only came about following a blanket ban in 2008.<sup>[108]</sup> This suggests that the blanket ban was what ‘forced’ the industry into action so that the ban could subsequently be lifted following product changes.

### Balloons

A number of states in the US have implemented local laws relating to helium balloon releases. In Hawaii, it is unlawful to release any helium balloon except if it is kept indoors or used for meteorological purposes, with a \$500 fine for violation. In Maryland, New Hampshire and New Jersey it is also an offence to release balloons. In both Connecticut and Florida, it is unlawful to release ten or more helium balloons within a 24-hour period, whilst in Tennessee, the rules apply for 25 balloons or more, and 50 balloons or more in Ohio within a one-hour period. In California, it is illegal to sell a helium balloon without affixing an object to the balloon to keep it tethered to the ground. In addition, in Australia, it is illegal to release any number of balloons into the atmosphere (Sunshine Coast) and it is illegal to release 20 or more balloons simultaneously in another (New South Wales).<sup>[110]</sup>

Finally, in Europe, some countries are proposing an extended producer responsibility (EPR) scheme to be introduced for balloons, and in so doing incorporate the helium balloon market as well. According to the European Balloon and Party Council (EBPC), the Netherlands, Finland, Sweden, and Germany are all currently undergoing studies to determine the exact content of litter from both voluntary and municipal waste collections to determine what the costs should be. However, in Germany, costs would likely be scaled according to the volume placed on the market, showing that different countries are taking different approaches. As part of the EPR scheme in the Netherlands, funds generated would also be used to raise consumer awareness to reduce the littering of balloons.

# 5.0 Public Attitudes and Perceptions

Data on public attitudes and perceptions around the items is taken from three public consultations regarding the items from local government.

- A public consultation on **sky lantern** use by the Isle of Man Government’s Office for Fair Trading (2015)[108]
- A public consultation on **single-use barbecues, sky lanterns, and balloons** on all publicly owned land and beaches by Brighton and Hove City Council[111]
- A public consultation on the use of **single-use barbecues** (as well as Personal Watercraft) in certain beach areas by Southend-on-Sea City Council[112]

When reading through the summary of the results, presented below, it is important to bear in mind that representative sampling was not conducted for any of the consultations, and respondents may represent a sample of the population with a particular interest in the item and/or its associated issues. In addition, whilst the views of members of the public are useful, they also are unlikely to possess the full range of available evidence, with views influenced strongly by media reporting. Therefore, public attitudes and perceptions are presented here not as a guide to policy, but as one indicator of how policy may potentially be received at the present moment in time.

## 5.1 Single-Use Barbecues

Southend-on-Sea’s consultation included a proposal for a restriction for barbecue use within a mapped zone, with an enforceable Public Spaces Protection Order (PSPO) for its reach. 434 residents responded to the consultation. Brighton and Hove’s City Council’s consultation was similarly to provide evidence for the restriction of barbecue use, but for all beachfront and all council owned land, via a PSPO. The consultation acquired 671 responses. Neither should be considered representative surveys, but they are perhaps useful in indicating some members of the public at least have high levels of concern. Some headlines from these consultations included:

- 65% of Southend-on-Sea respondents saw current levels of single-use barbecue use within the proposed restricted zone as a ‘very big problem’ or ‘fairly big problem’. This compares to 27% seeing bonfires as a ‘very big problem’ and 24% as a ‘fairly big problem’.
- For Brighton and Hove, 83.5% of respondents either strongly agreed or tended to agree that single-use barbecues cause problems for people, the environment and the council.
- 74% of Southend-on-Sea respondents supported the ban on single-use barbecues in the zone, with the most cited reason given (over 50% of respondents) due to fire risk. The second most cited reason given was public safety and/or danger to wildlife.
- In a free text section open for thoughts, 27% of respondents in Southend-on-Sea mentioned the installation of purpose-built designated areas for barbecue use.
- 79% of Brighton and Hove respondents strongly agreed or tended to agree that single-use barbecues should not be permitted on council owned land or the seafront and that a PSPO should be introduced to enable the issuance of fixed penalty notices for breaching the rules.

## 5.2 Sky Lanterns and Helium Balloons

Indications of reactions to these two items were found in two cases, one in Brighton and Hove (as above) and one from outside of England on the Isle of Man. Similar caveats apply to the non-representative nature of these surveys, but they do reflect a strand of concern among the public.

- **Sky lanterns and helium balloons:** In Brighton and Hove’s consultation, 90% of respondents strongly agreed or tended to agree that the release of lanterns and balloons outside causes problems for people, the environment and the council. 85% of respondents strongly agreed or tended to agree that a PSPO should be introduced to manage the non-permitted release of lanterns and balloons in or on council-owned parks, open spaces and the seafront.
- **Sky lanterns:** The Isle of Man’s consultation found that 84% of respondents thought that sky lanterns posed a ‘significant risk’ to public safety. 89% agreed with a ban on use, and 79% on only a ban on sales – as an interim measure. Comments for those disagreeing were often only that internet sales are a common means of obtaining them. 89% voted against a proposal in the consultation that instead of a ban, there should be mandatory product changes made by manufacturers to make sky lanterns safer, as well as improving consumer awareness of safer use through guidance.

## 6.0 Policy Appraisal

This section starts by outlining the longlist of policy options considered for each item, given the research conducted, and the shortlist of four policy options selected for policy appraisal (Section 6.1). Section 6.2 then sets out the main modelling assumptions and parameters used for the model. Section 6.3 then outlines the baseline and policy appraisal for the 3 policy options proposed for single-use barbecues and Section 6.4 for the policy option proposed for sky lanterns. These sections include the results of the cost-benefit analysis, including what the net benefits (or costs) are of each policy option, given the data and assumptions used in the appraisal.

### 6.1 Shortlisting of Policy Options

In order to narrow down to the four policy options for a full policy appraisal and cost-benefit analysis, a long list of policy options was considered, based on the research conducted.

The table below outlines a list of 11 interventions to potentially take forward to policy appraisal. The first grouped list of policy options lists those that are currently implemented, either partially (for example by some local authorities), historically (for example seasonal halts on sales or local agreements with retailers during drought months) or currently existing nationally (e.g., Codes of Practice). The second grouped list of policy options in the same table lists those under discussion in England and/or which have been implemented internationally.



**Table 6-1: Longlist of possible interventions**

Policy option (existing)		Govt Level	Single-use barbecues	Sky lanterns	Helium balloons
1	Voluntary local authority ban on their use on council or public land	Local		✓	✓
2	Use of existing bylaws banning the lighting of flammers, fires and stoves and/or use of the Countryside Rights of Way Act 2000 Schedule 2 for open access land and/or The Wildlife and Countryside Act 1981 for reckless damage to a Site of Special Scientific Interest (SSSI)	Local	✓		
3	Use of Public Spaces Protection Order (PSPO) and issuance of fixed penalty notice of £100 for use on land specified by the Council	Local	✓	(✓) <sup>28</sup>	(✓) <sup>29</sup>
4	Local agreements with retailers to halt sales during summer months	Local	✓		
5	Supermarkets halt sales in summer drought months	National	✓		
6	Voluntary Code of Practice: safe manufacturing & responsible sale	National		✓	(✓) <sup>30</sup>
7	Barbecue bins & guidance on safe use and disposal	Local	✓		
Policy option (international examples or under discussion domestically)		Govt Level	Single-use barbecues	Sky lanterns	Helium balloons
8	Make the release of balloons and sky lanterns an intentional act of littering and therefore enforceable by councils on their own land under the Clean Neighbourhoods and Environment Act 2005 and Environmental Protection Act 1990.	National/ Local		✓	✓
9	Voluntary Guidance: safe manufacturing & responsible sale	National	✓		
10	Country-wide ban on the sale or launch of sky lanterns (see e.g., Brazil, Australia, Germany, Spain, Malta)	National		✓	
11	Ban on sale/use of single-use barbecues	National	✓		

Following long-listing, specific policy options were discussed and where appropriate developed into measures that could be modelled in a formal cost-benefit analysis, with the intention of performing such an analysis on up to four policy measures.

<sup>28</sup> Limited examples of this form of legislation used.

<sup>29</sup> Limited examples of this form of legislation used.

<sup>30</sup> No universal Code of Practice for the item, instead various representative Trade Bodies have implemented their own Codes of Practice, with significant variation between them (e.g., policy on mass releases).

For **single-use barbecues**:

- Both total bans and narrower restrictions were discussed. Bans could be either sales or use based. In terms of scale, the ban could be a total ban, but could also be limited to a specific geography or “public land”. The possibility of also making it a seasonal ban instead, only banning its use during high-risk months, was discussed.
- An “Extended Producer Responsibility +” (“EPR+”) policy was discussed. This would entail a Product Stewardship / EPR-type intervention package that would encompass more than just the end-of-life costs (as is the sole focus of cost recovery in conventional EPR schemes), but also include the damage costs that the use of the item places on society and the environment.
- The final policy option discussed was the use of a controlled use policy option which would entail the provision of barbecue-designated areas with designated use and disposal provided by councils. This would form part of an extended “EPR+” scheme, to be called “EPR++”

For **sky lanterns**:

- The only policy option considered was a total sales ban. This is because it is assumed that, based on the research conducted and due to the nature of the product itself, there is no responsible use of a sky lantern, as every use-case will mean a release into the environment and lead to the associated environmental impacts or risks. A ban on the *release* (but not the *sale*) of the product was deemed ineffective as a national measure for the same reason (no consumer would buy the product without intending to use it). A total sales ban could also be easier to implement and enforce than a ban on release.

For **helium balloons**:

- Potential enforcement issues were discussed if local measures were introduced, or the ban was on their release only. Unlike sky lanterns, helium balloons may be used indoors, or outdoors with no intention of release, so responsible use cases for this product, with no impacts or risks beyond conventional waste management, are possible, and may represent the vast majority of use. It was also noted that both the prevalence of helium balloons, and the extent of mass release events, appears to have fallen in the past decade without government action being taken.

Following discussion, the four policy options shortlisted and taken forward for policy appraisal were:

- Policy Option 1: Total Ban on the Sale of Single-Use Barbecues
- Policy Option 2: EPR+ for Single-Use Barbecues
- Policy Option 3: EPR++ for Single-Use Barbecues
- Policy Option 4: Total Ban on the Sale of Sky Lanterns

A policy option was discounted for helium balloons as the research found this to be the item with the lowest impact, and less of a priority than the other two items.

## 6.2 Modelling Assumptions and Parameters

The following general assumptions and parameters were used throughout the model, for both sky lanterns and single-use barbecues:

- The model uses data that spans as far back as 2008.
- The future modelling period has been set to cover an 8-year span, from 2023 to 2030.
- All monetised costs and benefits have been modelled in real prices (removing the effects of inflation), using 2021 as the base year.
- To discount future costs and benefits (to account for the time preference of money), a Social Discount Rate of 3.5% has been used, based on HMT Green Book guidance.<sup>[113]</sup>
- In the baseline, variables were projected forwards for the period 2023-2030 based on actual data pre-2023, using a static baseline with no growth rate added (as opposed to a dynamic baseline with an increasing or decreasing trend). This is because not enough reliable historical time-series data was found showing either an increase or decrease in consumption, for either item. Likewise, in the case of the environmental impacts, there was no reliable indication to show change. With a large degree of uncertainty with the data in the first place, a static baseline was therefore considered the most defensible. While the research suggested a significant decline in sky lantern use over the past decade, this may well be due to reduced availability (following supermarket sales bans) and there is no reason to believe this is necessarily an ongoing change that should be projected forwards. Given the uncertainty in market trends and data, therefore, modelling a static baseline is unlikely to be any less accurate, and allows for the impact of policy to be clearer.
- In the absence of any reliable data on what proportion of the extra cost imposed by an EPR scheme is passed onto consumers, the model assumes that the full EPR cost and EPR fee is passed onto consumers through higher prices.
- The EPR costs paid for by producers of single-use barbecues are distributed to local authorities and other public institutions that manage the end-of-life waste and/or incur the damage.

## 6.3 Single-Use Barbecues

Three policy measures were assessed to tackle single-use barbecues. All three are compared to the same baseline.

### 6.3.1 Baseline

In order to assess the potential impacts of the shortlisted policy options, a baseline was estimated first, laying out the costs and benefits to which each of the policy options will be compared.

The following variables were included in the baseline for single-use barbecues (Table 6-2):

**Table 6-2: Impacts modelled for Single-Use Barbecues**

Type of impact	Impact (variable)
Economic benefits	Revenue from the sales of single-use barbecues
	Number of fires caused by single-use barbecues
	Fire & Rescue Service (FRS) response costs
	Cost of replacing bins damaged by fires
Environmental and social impacts	Cost of loss of ecosystem service provision of natural asset
	Cost of burns
	Litter costs (direct costs of litter clean-up and indirect costs associated with disamenity and other impacts)
	Collection and disposal costs

**Revenue from the sales of single-use barbecues**

The total number of single-use barbecues sold in England was estimated as **7.58 million per year**. See earlier sections for how this was calculated. At a retail price of £4.80 per barbecue, the revenue from the sale of barbecues was estimated as **£36.5 million per year**. This was the value used for the economic benefit of single-use barbecue sales.

**Fire & rescue service response costs due to fires**

The number of fires caused by single-use barbecues per year is an unknown and therefore had to be estimated for the purposes of the model. An estimated 5.73% of wildfires are caused by barbecues every year, calculated based on Natural England’s 2020 report[29] and Forestry Commission data. According to the Natural England report, out of 382 wildfires on heathland and peatland with cause identified, 39 were caused by barbecues (which is 10.2%). However, there were a total of 3,127 wildfires on heathland and peatland in that period, and if 39 of those were caused by barbecues, the % caused by barbecues would be 1.25%. An average of the two gives 5.73% of heathland and peatland wildfires caused by barbecues. The assumption was made that this was the % of all fires caused by barbecues. Between 2009 and 2021, there was an average of 44,664 wildfires per year. Multiplying these two figures together gives an estimated total of 2,558 fires. The assumption was then made that 95% of barbecue fires were caused by single-use barbecues. This gives an estimated total of 2,431 fires caused by single-use barbecues every year. (See also Section 3.1.2.2 and in the Appendix in Section A 4.0)

For Fire and Rescue Service (FRS) response costs per fire, the same assumption as the one used for sky lanterns was used (see Section 6.4.1).

***The total FRS response costs due to single-use barbecues were estimated at £1.27 million per year.***

## Bin fires

The number of bin fires caused by single-use barbecues every year was estimated at 455. This was estimated as follows. The average number of bins lost to single-use barbecue fires by each local authority in England is estimated as 2, based on data from North Norfolk and Brighton councils. According to the Keep Britain Tidy (KBT) survey, 68% of LAs have experienced damage to bins due to barbecues. Multiplying 2 by the number of local authorities in England (333) by 68% gives a total of 455 bin fires.

The cost of replacing one bin, including clear-up costs, was estimated to be £1,500, based on data from North Norfolk and Dorset councils.

***The total bin fire costs due to single-use barbecues were estimated at £682,010 per year.***

## Burns

Based on data from A&E admissions, the average number of minor burns caused by single-use barbecues every year is 100. The assumption was then made that treating a minor burn will cost the same as an average A&E walk-in and treatment, found to be £429 per burn, based on the Birmingham Mail<sup>[114]</sup>. Based on correspondence with the International Burn Injury Database<sup>[76]</sup>, the average number of major burns caused by single-use barbecues every year is 12. Data from the Children's Burns Trust<sup>[75]</sup> indicates that the cost of treating each major burn was £168,155 in 2022 (this has been adjusted downwards to £154,129 for the year 2021 to account for inflation)

***The total costs of treating minor and major burns due to single-use barbecues were estimated at £1.86 million per year.***

## Loss of natural assets due to fires

With the assumption that 5.73% of fires are caused by single-use barbecues, this amounts to 2,431 fires per year and an average of 526 hectares per year burnt by single-use barbecue fires over the course of the 2009-2021 period. Using Forestry Commission data, the area of different land cover classes burnt by single-use barbecue fires per year is estimated to be as follows:

- Woodlands: 38.3 ha per year
- Arable: 134 ha per year
- Heathland and peatland: 262 ha per year
- Built-Up Areas & Gardens: 91.4 ha per year

To estimate the damage costs of these fires in terms of the loss of ecosystem service provision of these natural assets, the Natural Capital Accounts Model developed by Eunomia (for a previous client) was used. The same estimations as the one used for sky lanterns were used (see Section 6.4.1 for more information). The area burnt per year of each of the land cover classes was inputted into the model, and the following were the results in terms of the cost per year of the loss of ecosystem service provision of these natural assets with respect to four components:

- Agricultural Production: £56,323 per year
- Air Pollution Removal: £38,605 per year
- Flood Regulation: £4,869 per year
- Climate Regulation: £148,049 per year

***This gives a total cost of £247,846 per year in loss of ecosystem service provision of these natural assets due to single-use barbecues.***

## Litter costs

In the absence of data on the percentage of barbecues that are disposed of responsibly or littered, an assumption was made that of the 6,709 tonnes of single-use barbecues consumed every year, 50% (3,355 tonnes) are thrown into litter bins in public places (therefore classified as bin litter), 25% (1,677 tonnes) are left on the ground in public places (therefore classified as ground litter), and 25% (1,677 tonnes) are disposed of at home and collected through kerbside residual waste.

### Direct litter costs

The direct cost of clearing bin litter was assumed to be £790 per tonne<sup>[115]</sup>. The direct cost of clearing ground litter was assumed to be £1,457 per tonne. See Section 6.4.1 on sky lanterns for detail on what direct litter costs entail. With 3,355 tonnes of bin litter and 1,677 tonnes of ground litter, **this gives a total cost of £5.09 million per year in direct litter costs.**

### Indirect litter costs

The indirect cost of litter was assumed to be £10,513 per tonne (see Section 6.4.1 for detail). **This gives a total cost of £17.6 million per year in indirect litter costs.**

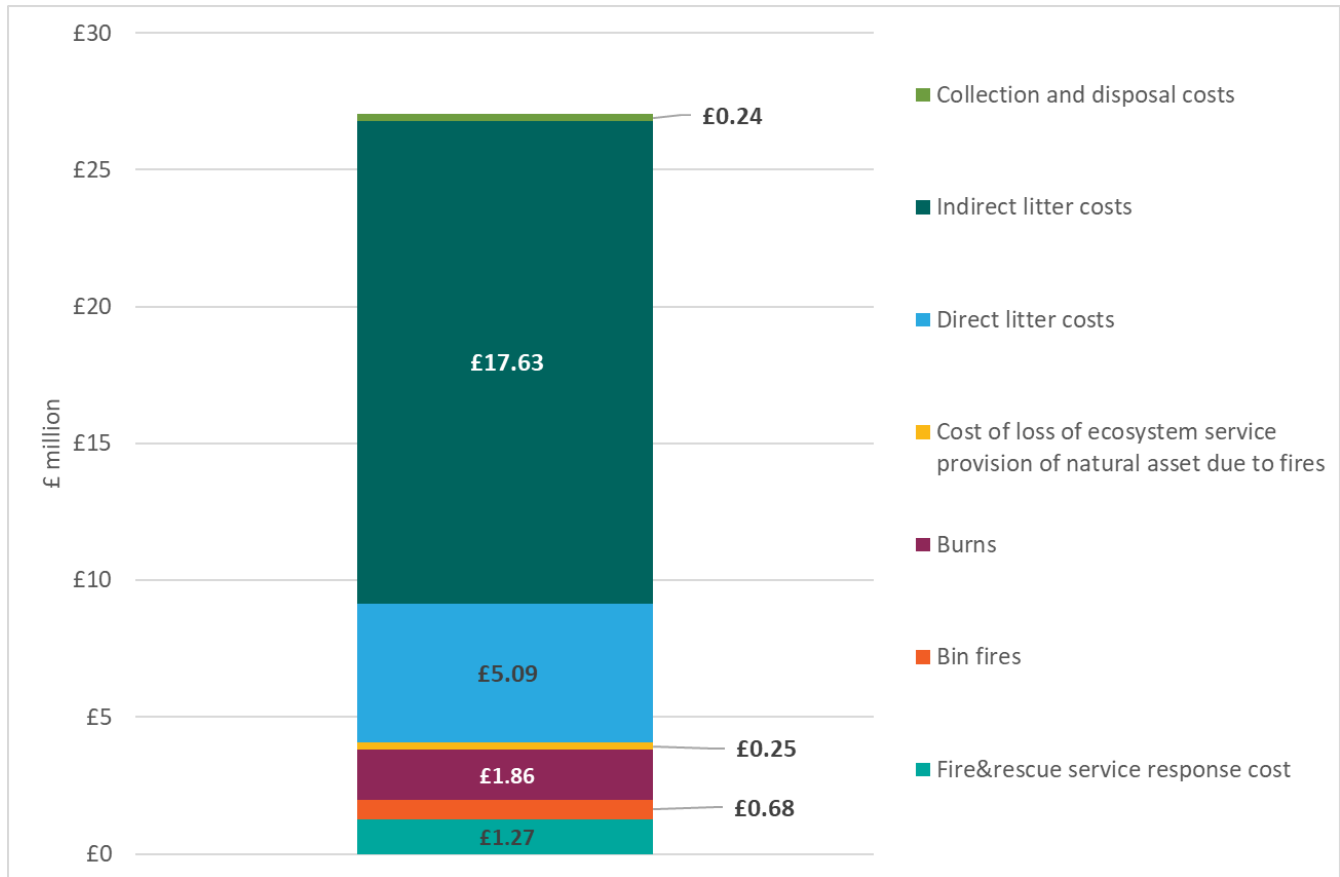
## Collection and disposal costs

The cost of collecting residual waste through kerbside collection was estimated to be £42 per tonne, based on Eunomia's previous experience undertaking collection modelling for four local authorities in the UK. With the assumption that 25% (1,677 tonnes) of single-use barbecues are disposed of at home and collected through kerbside residual waste, this gives a **total collection cost for single-use barbecues of £70,025 per year.**

The assumption was made that all single-use barbecues are disposed of through landfill (single-use barbecues are currently not recycled at all). At a cost of landfilling of £26 per tonne (excluding tax)<sup>[116]</sup>, this gives **a total disposal cost of £173,638 per year.**

The annual environmental and end-of-life costs of single-use barbecues are summarised in **Figure 6-1** below.

**Figure 6-1: Annual environmental and end-of-life costs of single-use barbecues**



In the baseline, in 2023:

- Benefits equal £36.4 million in sales of single-use barbecues.
- Costs equal £27 million in environmental impacts and end-of-life costs, with the vast majority (84%) due to litter costs (65.2% indirect, 18.8% direct).
- The net benefits in the baseline scenario equal +£9.32 million. Therefore, the sale of single-use barbecues imposes a net benefit on society.
- If the indirect costs of litter are removed, environmental impacts (costs) fall to £9.40 million, and net benefits become even more positive (+£27.0 million).

In the baseline, in 2023-2030:

- The Net Present Value (NPV) of the net benefits including the indirect costs of litter = +£66.3 million
- The NPV excluding the indirect costs of litter = +£192million

## 6.3.2 Policy Option 1: Total Ban on Sale of Single-Use Barbecues

### 6.3.2.1 Description

Policy Option 1 imposes a total ban on the sale of single-use barbecues. The ban on the sale of single-use barbecues is assumed to be 100% effective. In other words, no illegal sales take place. The ban on the sale of this item, therefore, means no barbecues are put on the market, sold or consumed, and therefore no environmental impacts result from them either.

Regulatory costs for introducing a ban on single-use barbecues were taken from the ban on single-use carrier bags (SUCB) in Wales<sup>[117]</sup>. These consist of the following:

#### Start-up costs

Start-up costs were assumed to be one-off and only incurred in year 1 of the ban. Start-up costs were assumed to be constant regardless of market size for each item and therefore were assumed to be the same for single-use barbecues as they were for SUCB.

- Advertising the ban: £400,000
- Introducing the legislation: £180,000

#### Management costs

For the ban on SUCB in Wales, these were estimated to be £180,000 per year. As the market for single-use barbecues is smaller than that of SUCB, management costs for a ban of single-use barbecues were assumed to be half, and therefore **£90,000 per year**.

#### Enforcement costs

For the ban on SUCB in Wales, these were estimated to be £500,000 per year. As the market for single-use barbecues is smaller than that of SUCB, enforcement costs for a ban on single-use barbecues were assumed to be half, therefore **£250,000 per year**.

### 6.3.2.2 Cost-Benefit Analysis

Under the ban on the sale of single-use barbecues, in 2023:

- All sales of single-use barbecues come to a halt, therefore benefits go to 0.
- No negative environmental impacts result (given that no single-use barbecues are sold), therefore costs go to 0.
- The regulatory costs of the ban amount to £920,000
- The net benefits in the Policy Option 1 (ban) scenario equal -£920,000
- The net benefits of the Policy Option 1 (ban) scenario compared to the baseline equal -£10.2 million. Therefore, the policy delivers a loss of £10.2 million in year 1.

Under the ban on the sale of single-use barbecues, in 2023-2030:

- The Net Present Value (NPV) of the net benefits of the Policy Option 1 (ban) scenario compared to the baseline equal -£69.3 million. **Therefore, the policy delivers a loss of £69.3 million over the 8-year period.**



## 6.3.3 Policy Option 2: EPR+

### 6.3.3.1 Description

Policy Option 2 describes the introduction of an Extended Producer Responsibility (EPR) scheme for single-use barbecues but extends the cost coverage seen in existing EPR schemes (which is limited to end-of-life costs) to also include the costs arising from irresponsible use of single-use barbecues, or in other words, the damage costs described in the baseline. This policy option is therefore labelled EPR+. As well as enabling cost recovery, this creates an incentive for the industry to take steps to reduce those costs.

A traditional EPR prices into the price of the good the end-of-life costs (collection, transport, disposal) as well as EPR scheme costs, and in some cases, litter costs. In this policy option 2, the damage costs (environmental impacts) were also priced in. Therefore, the following costs were priced into the price of a single-use barbecue, as part of the EPR+ scheme proposed:

Type of cost	Cost	Source/estimation	Cost (£)
End-of-life costs	Collection	Estimated used the methods outlined earlier in the report	£70,025
	Disposal	Estimated used the methods outlined earlier in the report	£173,638
Damage costs	Fire & Rescue Service (FRS) response costs	Estimated using the methods outlined earlier in the report. Ecosystem service costs cover four key components but may not capture all aspects of fire damage.	£9,154,715
	Bin fires		
	Burns		
	Cost of loss of ecosystem service provision of natural assets due to fires		
	Direct litter costs		
	Start-up costs	Start-up costs for the EPR+ scheme were assumed to be the same as for the ban (see Section 6.3.2 on the ban).	£580,000
EPR scheme costs	Government operational costs	These costs were based on the study Eunomia has conducted for WRAP on a basic EPR for textiles. Government operational costs consist of operational costs, non-labour HR costs, core team costs, IT Costs, employee costs for LA related activities, employee costs for producer related activities, and governance, and amount to a total of £7.98 per tonne.	£53,571
	PRO costs	These costs were based on the study Eunomia has conducted for WRAP on a basic EPR for textiles. PRO costs consist of operating costs, compliance costs and monitoring costs, and amount to a total of £10.31 per tonne.	£69,151

All the above costs amount to a **total of £10.1 million in the first year of the scheme** (2023). This total cost is divided by the number of single-use barbecues sold (7.58 million) to calculate the additional price to be added onto the base price of a single-use barbecue (the EPR fee). Further information on modelling assumptions and parameters can be found in Section 6.2. This gives an EPR fee of £1.33 to be added onto the base price of £4.80, to give a new price of a single-use barbecue (with the EPR fee) of £6.13. This is a price increase of 28%.

No studies were found on the Price Elasticity of Demand (PED) of single-use barbecues, therefore, to estimate the reduction in the demand of single-use barbecues as a result of the price increase, a PED of -1.2 was assumed. Single-use barbecues were assumed to be mildly elastic, meaning demand decreases by a greater percentage than price increases, as it was assumed single-use barbecues have substitute goods, and therefore consumers would respond to the price increases by switching to other means of cooking or consuming food. A PED of -1.2 means that a 28% increase in price leads to a reduction in demand by 34%, to 5.65 million units.

For subsequent years, as the number of barbecues consumed falls in line with the increase in price, the damage costs as well as the other costs priced into the price of a single-use barbecue also fall. The price for the 2024-2030 period, therefore, falls to £6.05 per barbecue (EPR fee of £1.26) and the demand increases to 5.73 million units per year.

### 6.3.3.2 Cost-Benefit Analysis

Under the EPR+ policy option 2 scenario, in 2023:

- Sales of single-use barbecues fall to 5.65 million units, therefore benefits fall from £36.4 million (2022) to £27.1 million (2023).
- Negative environmental impacts fall, as damage and end-of-life costs fall from £27 million (2022) to £20.1 million (2023). The breakdown of the reduction in impacts is as follows:
  - Fire & rescue service response costs due to fires fall from £1.27 million to £0.95 million,
  - costs due to bin fires fall from £0.682 million to £0.508 million,
  - costs due to burns fall from £1.86 million to £1.38 million,
  - the cost of loss of ecosystem service provision of natural assets falls from £0.248 million to £0.185 million,
  - direct litter costs fall from £5.09 million to £3.80 million,
  - indirect litter costs fall from £17.6 million to £13.1 million, and
  - collection and disposal costs fall from £0.244 million to £0.182 million.
- The EPR costs amount to £702,722.
- The net benefits in the Policy Option 2 (EPR+) scenario equal +£6.24 million.
- The net benefits of the Policy Option 2 (EPR+) scenario compared to the baseline equal -£3.08 million. **Therefore, the policy delivers a loss of £3.08 million in year 1.**

Under the EPR+ policy option 2 scenario, in 2023-2030:

- The Net Present Value (NPV) of the net benefits of the Policy Option 2 (EPR+) scenario compared to the baseline equal -£17.5 million. **Therefore, the policy delivers a loss of £17.5 million over the 8-year period.**

Further information on modelling assumptions and parameters can be found in Section 6.2.

## 6.3.4 Policy Option 3: EPR++

### 6.3.4.1 Description

Policy Option 3 describes the introduction of an EPR scheme for single-use barbecues but extending the cost coverage seen in the EPR+ scheme in Policy Option 2 to additionally cover the costs of measures to reduce irresponsible use. This policy option is described as EPR++.

The costs priced into the price of a single-use barbecue as part of the enhanced EPR++ scheme are those of the EPR+ with the addition of the costs of additional measures to reduce their irresponsible use. The following additional costs were priced into the EPR scheme:

#### Provision of safe locations for use: **£5.59 million per year** (in 2023)

The provision of safe locations for use consisted of installing paving slabs for safe barbecuing in parks and public spaces, and single-use barbecue disposal bins for their safe disposal.

The cost of a 60cm x 60cm x 5cm paving slab (assumed safe for single-use barbecue use) was found to be £13 per paving slab. The number of labour hours needed to install 1 paving slab was assumed to be 1 hour, and at minimum wage, this amounts to £9 per paving slab. The number of paving slabs needed per park or green space was assumed to be 10.

The cost of a single-use barbecue disposal bin was found to be £490<sup>[118]</sup> per bin. The number of labour hours needed to install 1 disposal bin was assumed to be 3 hours, and at minimum wage, this amounts to £27 per disposal bin. The number of disposal bins needed per park or green space was assumed to be 1.

The number of parks and green spaces across the UK was estimated to be 27,000, according to House of Commons Public parks<sup>[119]</sup>, and scaled down by population, 22,742 in England. The assumption was then made that paving slabs and disposal bins would be installed in 1/3 of all of England's parks and/or green spaces, therefore in a total of 7,591 parks and/or green spaces. This was assumption was based on the fact that a significant proportion of the 22,742 parks and/or green spaces would be too small or not suitable for barbecuing.

This gives a total of £3.92 million per year to install one single-use barbecue disposal bin in 1/3 of England's park and/or green spaces, and £1.66 million to install 10 paving slabs in each of 1/3 of England's park and/or green spaces. The total cost amounts to £5.59 million per year.

#### Localised campaign and communications: **£11.8 million per year** (in 2023)

To estimate the cost of implementing localised campaigns and communications for the safe and appropriate use of single-use barbecues, as well as warnings on their potential dangers and impacts if misused, the Dorset Council case study was used. When engaged, Dorset Council reported they spent a total of £35,400 a year for their campaign on single-use barbecues. This consisted of staff costs (including communications, officer lead costs and design costs), costs for banners, signs, posters, leaflets, other campaign materials at their heathland and our country park sites, and the cost of season wardens. This cost multiplied by the total number of local authorities in England (333), if these campaigns were to be launched at local authority level in every local authority in England, gives a total cost of £11.8 million.

### 6.3.4.2 Cost-Benefit Analysis

Under the EPR++ policy option 3 scenario, in 2023:

- Sales of single-use barbecues fall to 3.86 million units, therefore benefits fall from £36.4 million (2022) to £18.5 million (2023).
- Negative environmental impacts fall, as damage and end-of-life costs fall from £27 million (2022) to £13.8 million (2023). The breakdown of the reduction in impacts is as follows:
  - Fire & rescue service response costs due to fires fall from £1.27 million to £0.65 million,
  - costs due to bin fires fall from £0.682 million to £0.347 million,
  - costs due to burns fall from £1.86 million to £0.94 million,
  - the cost of loss of ecosystem service provision of natural asset falls from £0.248 million to £0.126 million,
  - direct litter costs fall from £5.09 million to £2.59 million,
  - indirect litter costs fall from £17.6 million to £8.97 million, and
  - collection and disposal costs fall from £0.244 million to £0.124 million
- The reduction in damage and end-of-life costs is wholly due to the increase in the price of single-use barbecues causing a drop in consumption. The impact each of the measures to reduce irresponsible use could have on reducing impacts and costs further has not been modelled as it is difficult to predict with enough certainty how effective in magnitude each measure will be in reducing impacts.
- The EPR costs amount to £702,722.
- The net benefits in the Policy Option 3 (EPR++) scenario equal +£4.04 million.
- The net benefits of the Policy Option 3 (EPR++) scenario compared to the baseline equal -£5.28 million. **Therefore, the policy delivers a loss of £5.28 million in year 1.**

Under the EPR+ policy option 2 scenario, in 2023-2030:

- The Net Present Value (NPV) of the net benefits of the Policy Option 3 (EPR++) scenario compared to the baseline equal -£33.3 million. **Therefore, the policy delivers a loss of £33.3 million over the 8-year period.**

### 6.3.5 Summary of Policy Appraisal

Figure 6-2 below summarises the results of the cost-benefit analysis of the baseline and the three policy options for single-use barbecues. The analysis has shown that, given the data found and the assumptions used in the model, all three policy options would deliver a net cost to society, with the ban on single-use barbecues imposing the largest cost (£69 million over eight years, compared to the baseline scenario), while the EPR+ imposes the smallest cost (£17.5 million over 8 years, compared to the baseline scenario). These net costs largely result from loss of sales.

**Figure 6-2: Cost-benefit analysis of three policy options for single-use barbecues vs baseline (2023)**



## 6.4 Sky Lanterns

### 6.4.1 Baseline

In order to assess the potential impacts of the shortlisted policy options, a baseline needs to be set first, laying out the costs and benefits to which each of the policy options will be compared against. The following variables were included in the baseline for sky lanterns (Table 6-3):

**Table 6-3: Impacts modelled for Sky Lanterns**

Type of impact	Impact (variable)
Economic benefits	Revenue from the sales of sky lanterns
	Number of fires caused by sky lanterns
	Fire & Rescue Service (FRS) response costs
	Cost of loss of ecosystem service provision of natural asset
Environmental and social impacts	Litter costs (direct costs of litter clean-up and indirect costs associated with disamenity and other impacts)
	Animal health
	Coastal rescue
	Aviation incidents

### **Revenue from the sales of sky lanterns**

The total number of sky lanterns sold and released into the environment in England was estimated as **1.90 million per year**. See earlier sections for how this was calculated. At a retail price of £2.27 per sky lantern<sup>31</sup>, the revenue from the sale of sky lanterns was estimated as **£4.31 million per year**. This was the value used for the economic benefit of sky lantern sales.

### **Fire & rescue service response costs due to fires**

The number of fires caused by sky lanterns per year is an unknown and therefore had to be estimated for the purposes of the model. According to the Defra 2013 report, from 26 Fire and Rescue Services (FRS) surveyed, there were an estimated 81 separate fires caused by sky lanterns over a five-year period. A more up-to-date figure was not found therefore this was the figure used for the model. This amounts to 0.6 incidents of fires per year reported per FRS. There are 45 FRS in England according to the Local Government Association[120]. Therefore, the estimated number of fires caused by sky lanterns is **28 per year**.

The size of each of the fires caused by sky lanterns is another unknown and therefore had to be estimated for the purposes of the model. According to Forestry Commission data, fires can range in area damaged from 0-5m<sup>2</sup> to 7,000 hectares (70,000,000m<sup>2</sup>), and in length of time, from 0 to 175 hours in duration. The Forestry Commission data shows that most fires are very small: 78% are under 20m<sup>2</sup>, and 95% are under 200m<sup>2</sup>. Therefore, it was assumed that 78% of the 28 sky lantern fires are of the 'small' type. For these 'small' fires, the assumption was made that it would take 1 hour to diffuse, at a cost of £364 per fire. This £364 cost is the cost of 1 hour of major appliance and crew, according to Devon & Somerset FRS[121]. It was then assumed that the remaining 22% of the 28 sky lantern fires are of the 'larger' type and take 3 hours to diffuse.

***The total FRS response costs due to sky lantern fires were estimated at £14,708 per year.***

### **Loss of natural asset due to fires**

With the assumption that 0.07% of fires are caused by sky lanterns, this amounts to 28 fires per year and an average of 6.40 hectares per year burnt by sky lantern fires over the course of the 2009-2021 period. Using Forestry Commission data, the area of different land cover classes burnt by sky lantern fires per year is estimated to be as follows:

- Woodlands: 0.47 ha per year
- Arable: 1.63 ha per year
- Heathland and peatland: 3.19 ha per year
- Built-Up Areas & Gardens: 1.11 ha per year

To estimate the damage costs of these fires in terms of the loss of ecosystem service provision of these natural assets, Eunomia used a pre-existing in-house model, our Natural Capital Accounts Model, with the outputs used as inputs for the current study. This model estimates the monetary value that different habitat types (land cover classes) provide in terms of ecosystem services. These include provisioning services (e.g., agricultural production), supporting services (e.g., biodiversity), regulating services (e.g., air pollution removal) and cultural services (e.g., recreation). For the purposes of this model, the following four ecosystem services were included: Agricultural Production, Air Pollution Removal, Flood Regulation and Climate Regulation.

<sup>31</sup> Source: Defra (2013), 'Sky lanterns and helium balloons an assessment of impacts on livestock and the environment'. Average price in 2013 was found to be £2.00, adjusted upwards for inflation to £2.27 in 2021.

The area burnt per year of each of the land cover classes was inputted into the model, and the following were the results in terms of the cost per year of the loss of ecosystem service provision of these natural assets against the following four components:

- Agricultural Production: £685 per year
- Air Pollution Removal: £469 per year
- Flood Regulation: £59 per year
- Climate Regulation: £1,800 per year

***This gives a total cost of £3,014 per year in loss of ecosystem service provision of these natural assets.***

## **Litter costs**

A total of 1.90 million sky lanterns were assumed to be released every year in England, amounting to 171 tonnes per year (at 0.90 kg per sky lantern<sup>32</sup>). When calculating litter costs, the project team assumed 100% of sky lanterns ended up in the ground as ground litter.

### Direct litter costs

These direct costs of litter are the costs incurred by local authorities and other duty bodies when addressing the immediate impacts of litter. It refers to the costs of clean-up, clearance, treatment, and disposal, including personnel. The direct cost of clearing ground litter was assumed to be £1,457 per tonne[115]. This cost figure was given by Loch Lomond and the Trossachs National Park in the 2013 study Eunomia conducted for ZWS on the Direct Costs of Litter to Scottish Local Authorities and other Duty Bodies. It is calculated by adding personnel costs (£25,000) to uplift & disposal costs (£9,966) and dividing by the total tonnage of ground litter collected (24 tonnes). The £1,457 per tonne figure is conservative compared to the £2,567 per tonne figure calculated from the 2022 study Eunomia conducted for the Scottish Government on the Scale and Cost of Litter and fly tipping in Scotland. The direct costs for the clearance of litter, in both studies, included:

- Personnel – including employees involved directly in clearance, as well as resources required for their management;
- Equipment – including uniforms and non-mechanical equipment such as bags, orderly carts and litter pickers;
- Fleet – vehicles involved in collecting litter, including for staff supervision, and fuel and maintenance costs;
- Facilities – depots for storage of vehicles and equipment;

***This gives a total cost of £248,503 per year in direct litter costs.***

### Indirect litter costs

The indirect costs of litter are those incurred by individuals or organisations as a result of littering, but not due to directly removing or processing them. These indirect costs are much more difficult to quantify and monetise but include the cost of litter related injuries, impacts of litter on mental wellbeing, litter as the cause of wildfires, costs of litter related flooding, effects of litter on house prices, litter-related costs of vermin and more. The indirect cost of litter was assumed to be £10,513 per tonne[115], a much higher per tonne figure than direct costs. This is calculated from the 2022 study Eunomia conducted for the Scottish Government on the Scale and Cost of Litter and fly tipping in Scotland. Of those indirect costs that were able to be quantified and monetised in the study, 56% of the indirect

<sup>32</sup> Selected producer websites: Candle Bags UK (<https://www.candlebagsuk.co.uk/chinese-sky-lanterns-v4-white.html>), Night Sky Lanterns (<https://www.nightskylanterns.co.uk/10-traditional-chinese-sky-lanterns-v4-white.php>), Sky Lighter (<https://www.skylighter.com/blogs/how-to-make-fireworks/how-to-make-chinese-sky-lanterns>)

costs were attributed to negative effects on house prices, 29% to the negative effects on mental health, 10% to the effect of litter as a causal factor in crime, with the other 5.2% due to litter related anti-depressants, litter-related traffic accidents, car tyre puncture repairs, bike tyre puncture repairs, rat damage repairs, rat control and litter as a cause of wildfires. It is important to note the indirect costs of litter include other costs that were not able to be monetised. This generic cost for indirect litter impacts does not translate to all items equally in practice, however, the very high levels of concern around sky lanterns and their impacts do help justify the case that disamenity may be high for these items.

***This gives a total cost of £1,793,102 per year in indirect litter costs.***

### **Animal health**

The number of animal injuries and deaths caused by sky lantern ingestion per year is an unknown and therefore had to be estimated for the purposes of the model. According to the Defra 2013 report, there were 16 fatalities and injuries caused by sky lanterns over 4 years of reporting, and therefore an average of 4 per year. This figure was then multiplied by 10 to account for the fact that, according to the British Horse Society, reported incidents are an estimated 10 times lower than actual incidents. Therefore 40 incidents per year were assumed.

The damage cost of these deaths was then estimated based on the average cost of a farm animal (sheep, horse and cow). These costs were taken from various sources, and the average was assumed to be £1,316 per animal.

It is important to note that despite the uncertainty regarding the number of animal health issues caused by sky lantern ingestion, and the associated damage cost, this cost category is not a determining factor in the overall cost-benefit analysis, as it represents just 2.2% of overall damage costs.

***This gives a total cost of £52,623 per year in animal health damage costs.***

### **Coastal rescue**

The number of false alarm coastal rescue incidents caused by sky lanterns is an unknown and was estimated based on figures from the 2013 Defra report. This report estimated an average of 280 incidents per year due to sky lanterns, in the period between 2007 and 2012. These 280 incidents range from low impact incidents, where the emergency operator has determined that the (supposed) red flare was actually a sky lantern and aborted any further action, to high impact incidents, where full deployment of Search and Rescue (SAR) vehicles was initiated. The assumption was made that out of the 280 per year, 90% of them are of the low impact types, and 10% of the high impact types.

For the low impact types, the cost per incident was assumed to be the cost of an operator answering a call for half an hour (£4.46, at 2021 minimum wage). For the high impact types, the assumption was made that a lifeboat had to be deployed. The cost of deploying a lifeboat was found to be £1,706 per hour<sup>33</sup> and it was assumed it took 1 hour to resolve (SAR helicopters are also deployed for these incidents but these were omitted from the model).

***This gives a total cost of £48,864 per year in coastal rescue incidents.***

<sup>33</sup> Defra 2013 report, £1,500/hr inflated to 2021 base prices.



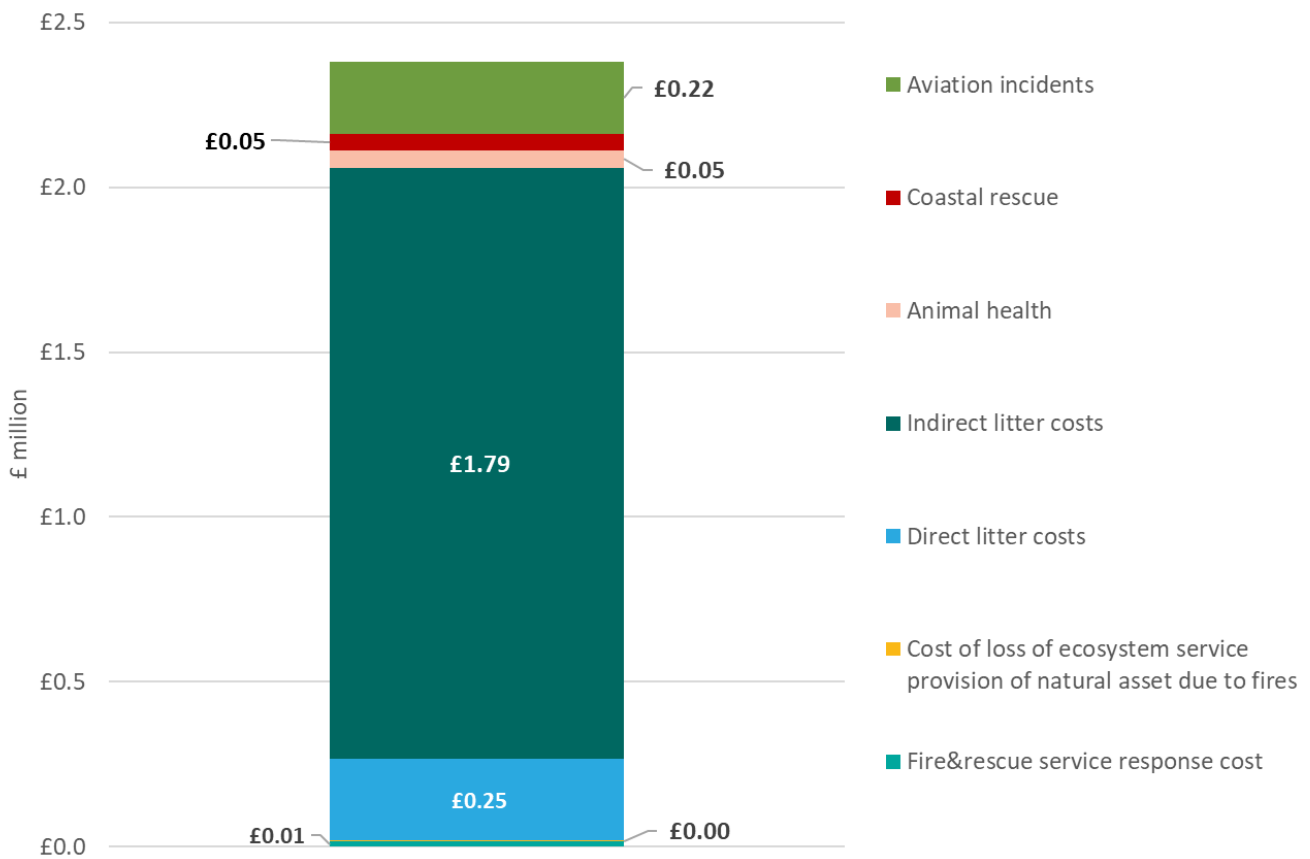
### Aviation incidents

The number of aviation incidents caused by sky lanterns is an unknown and was estimated based on figures obtained from correspondence with the Civil Aviation Authority (CAA). The CAA reported to Eunomia that between 2012 and 2022, a total of 26 Mandatory Occurrence Reports (MORs) were filed by airports with the CAA, at an average of 2.4 per year.

The cost per incident was then estimated to be £92,313. This was estimated from cost per Foreign Object Debris (FOD) incidents reported by Insight SRI[122]. If all the direct and indirect costs due to FOD for the 300 largest airports are included, the cost per FOD incident was estimated as £184,338. If just delay costs (a type of indirect cost) are included, the cost is just £288 per FOD incident. An average of the two gives £92,313 per incident.

*This gives a total cost of £218,194 per year in aviation incidents.*

**Figure 6-3: Annual environmental and social costs of sky lanterns**



In the baseline, in 2023:

- Benefits equal £4.31 million in sales of sky lanterns.
- Costs equal £2.38 million in environmental and social impacts, with the vast majority (86%) due to litter costs (75.4% indirect, 10.4% direct).
- The Net Present Value (NPV) of the net benefits in the baseline scenario equal +£1.93 million. Therefore, the sale of sky lanterns imposes a net benefit on society, despite the large litter impacts.
- If the indirect costs of litter are removed, environmental impacts (costs) fall to £0.59 million, and the NPV becomes even more positive (+£3.73 million).

In the baseline, in 2023-2030:

- NPV including the indirect costs of litter = +£13.7 million
- NPV excluding the indirect costs of litter = +£26.5 million

## 6.4.2 Policy Option 4: Total Ban on Sale of Sky Lanterns

### 6.4.2.1 Description

Policy Option 4 imposes a total ban on the sale of sky lanterns. The ban on the sale of sky lanterns is assumed to be 100% effective. In other words, no illegal sales take place. The ban on the sale of this item, therefore, means no sky lanterns are put on the market and sold, and none are released, and therefore no environmental impacts result from them either.

Regulatory costs for introducing a ban on sky lanterns were taken from the ban on single-use carrier bags (SUCB) in Wales<sup>[117]</sup>. These consist of the following:

#### Start-up costs

Start-up costs were assumed to be one-off and only incurred in year 1 of the ban. Start-up costs were assumed to be constant regardless of market size for each item and therefore were assumed to be the same for sky lanterns as they were for SUCB.

- Advertising the ban: **£400,000**
- Introducing the legislation: **£180,000**

#### Management costs

For the ban on SUCB in Wales, these were estimated to be £180,000 per year. As the market for sky lanterns is smaller than that of single-use barbecues, management costs for a ban of sky lanterns were assumed to be half that of single-use barbecues, and therefore **£45,000 per year**.

#### Enforcement costs:

For the ban on SUCB in Wales, these were estimated to be £500,000 per year. As the market for sky lanterns is smaller than that of single-use barbecues, enforcement costs for a ban of sky lanterns were assumed to be half that of single-use barbecues, and therefore **£125,000 per year**.

### 6.4.2.2 Cost-Benefit Analysis

Under the ban on the sale of sky lanterns, in 2023:

- All sales of sky lanterns come to a halt, therefore benefits go to 0.
- No impacts result (given that no sky lanterns are released into the environment), therefore costs go to 0.
- The regulatory costs of the ban amount to £750,000
- The net benefits in the Policy Option 4 (ban) scenario equal -£750,000
- The net benefits of the Policy Option 4 (ban) scenario compared to the baseline equal -£2.68 million. **Therefore, the policy delivers a loss of £2.68 million in year 1.**

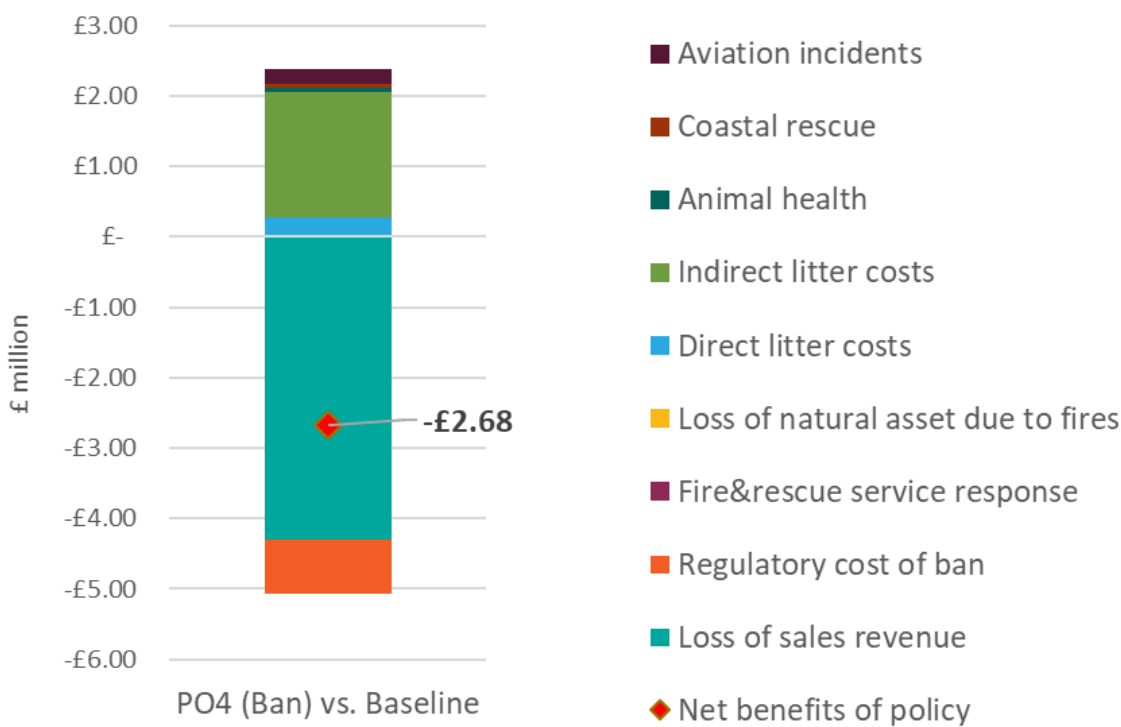
Under the ban on the sale of sky lanterns, in 2023-2030:

- The Net Present Value (NPV) of the net benefits of the Policy Option 4 (ban) scenario compared to the baseline equal -£15.5 million. **Therefore, the policy delivers a loss of £15.5 million over the 8-year period.**

### 6.4.3 Summary of Policy Appraisal

Figure 6-4 below summarises the results of the cost-benefit analysis of the baseline and the ban on sky lanterns. The analysis has shown that, given the data found and the assumptions used in the model, a ban on sky lanterns would deliver a net cost to society of £2.68 million in 2023 compared to the baseline scenario. This net cost is driven primarily by lost sales.

**Figure 6-4: Cost-benefit analysis of a ban on sky lanterns vs baseline (2023)**



# 7.0 Conclusions

This section highlights key conclusions from the wide range of evidence obtained for this study, as well as the modelling analysis undertaken. It highlights uncertainties and additional considerations that should be borne in mind when interpreting the modelling results, as well as the insight that comes from the evidence but was not explicitly modelled.

## 7.1 Costs, Benefits and Risks of Potential Policy Measures from the Modelling

In interpreting the headline model results, there are a number of key considerations that must be borne in mind.

### **Impacts of assumptions and data uncertainties on the results of the policy appraisal**

It is important to note that the results of the policy appraisal and cost-benefit analyses for each of the policy options presented in Section 6.0 are based on a large degree of data gaps and uncertainty across costs and benefits. Sales numbers and damage costs for both items have uncertainties associated with them. Due to this, a series of assumptions, all set out in Sections 6.3.1 and 6.4.1, have been made in the modelling and policy appraisal in order to estimate overall costs and benefits.

Importantly, both costs and benefits are bounded in scope in this analysis, and this boundary may impact results significantly. The benefits of sky lantern and single-use barbecue use in the policy appraisal have been limited to the revenue made from the sale of the items, i.e., the economic benefit of their sale. It could be argued that there are additional social benefits delivered by sky lanterns and single-use barbecues not captured by sales revenue. It can also be argued that any money not spent as a result of control measures would in fact be spent on alternative leisure activities, creating a distributional impact between sectors, but significantly less of a net loss than shown. Finally, there are likely additional negative impacts (costs) not included in the policy appraisal. These might include the potential risks of rare catastrophic events, for which historical evidence is lacking, or elements of impact that are poorly evidenced or quantified, which might justify a more precautionary approach than the quantitative results alone.

Therefore, the results of the policy appraisal and the resulting net costs of each policy option must be taken with a degree of caution, as they are the best estimates produced given the current availability of data.

### **Litter cost data improvements might change the picture**

A key environmental cost component in all four policy options is the direct and indirect (but in particular the latter) cost of litter. The indirect cost of litter has been estimated to be £17.6 million for barbecues and £1.79 million for sky lanterns. In both cases, indirect litter costs make up above 65% of the overall environmental and social costs of the items, based on an average disamenity cost per tonne of litter in other studies Eunomia has conducted. There is however an argument that an even higher figure may be justified. Public concern is clearly very high for both of these items, based on both the research and stakeholder feedback for this project. Therefore, while no primary research on disamenity impacts from these specific items has been carried out, the true disamenity impact per tonne for these particular items may well be higher, especially if fire concerns were factored in. This would potentially make the case

for policy intervention (in the form of a ban for either single-use barbecues or sky lanterns, or an EPR scheme for single-use barbecues) stronger.

### **Rare very high impact events may not be well reflected in the available datasets**

The model used in this policy appraisal has assumed *no* huge or catastrophic (very high impact) fires are caused by either of these items on an annual basis (it has assumed all fires cost up to a maximum of 3 hours and few personnel to diffuse, as the data shows 98% of fires are under 1,000m<sup>2</sup>). If, however, just one of these large scale, very high impact and high-cost fires were caused by one of these items, then the results of the CBA would change significantly, pushing up costs and making the case for a policy intervention much stronger. The application of a precautionary approach might therefore mean that it is worth regulating these items to avoid the risks of low frequency, very high impact fire events potentially caused by these items. There is evidence to suggest this might happen. Our research showed that 4 very high impact fires (costing fire response authorities £250,000 or above to diffuse) were caused by single-use barbecues in the period 2018-2022, and 1 by sky lanterns in the period 2013-2022.

Therefore, if we were to try and estimate this, the use of single-use barbecues may result in 1 very high impact fire every 1 to 2 years, and the use of sky lanterns may result in 1 very high impact fire every 10 years. As an example, the release of a sky lantern caused a huge blaze at a recycling plant in the West Midlands in 2013, leading to the injury of nine firefighters and costing an estimated £5 million. Therefore, if just one of these high impact events was factored in, this would likely change the decision matrix.

Eunomia did not increase the rate of fires to account for climate change over the relatively short period modelled in this study. Nonetheless, the risk that historical fire data, with or without consideration of low frequency very high impact events, may not be an entirely accurate guide to future risk is another reason why a more precautionary approach than that seen in the quantitative analysis based on past impacts might still be considered.

### **Considerations specific to the ban on the sale of single-use barbecues and sky lanterns**

The results of the cost-benefit analyses for a ban on the sale of single-use barbecues and sky lanterns are negative in both cases (-£10.2 million and £-2.68 million in 2023, respectively). Therefore, both bans would impose a net cost to society. This cost comes almost entirely from lost sales, and some of the limitations of assumptions on how this might be distributed in practice, as well as uncertainties in elements of the cost and benefit data have already been highlighted.

By introducing a ban, all negative environmental and social risks and impacts (fires, litter, etc.), which are currently borne by society as a whole, would in theory be eliminated, a significant advantage to this approach. This advantage may be less than anticipated, however, if illegal import, most likely via online sales channels, continued. A ban on the domestic sale of either item might not in practice eliminate this risk, and this would be worth taking into account when formulating and introducing a policy of this nature.

### **Considerations specific to EPR+ for single-use barbecues**

The per-unit damage costs caused by a single-use barbecue have been assumed to remain constant. In other words, the environmental and social costs that the use of a single-use barbecue imposes on society are modelled to not change from year to year.

The total damage costs from the use of single-use barbecues, however, do vary, changing according to the number of single-use barbecues consumed – and the number of irresponsible uses that lead to an incident. Bad fire years might

be expected to occur somewhat independently of consumption (though consumption is also likely to be higher in hot sunny weather for this item too). If EPR+ fees were linked to annual damage costs like this, if damage costs were found to be higher one year, (e.g., due to a large fire), the EPR+ fee charged to producers (and the resulting impact on product price) should increase the following year too. This could lead to unpredictable costs accrued by producers.

One alternative would be to cap the annual payout under the compensation scheme or to cap the contribution to the compensation scheme to the average amount in any given year. While improving producer predictability, these approaches could leave compensation payments short of true costs in some years. Balancing these considerations would need careful thought, but the principle of EPR+, that producers should take responsibility for wider impacts from their products than end-of-life costs alone, is worth further exploration in terms of practical implementation.

Even though both EPR+ and EPR++ policy options result in a net cost to society as a whole in this analysis, these policies are both shifting the burden of cost away from local authorities, public authorities (e.g., fire and rescue services) and ultimately the general public (through taxation), to the specific producers and consumers of single-use barbecues, which is the main aim of any EPR scheme. While the status quo shows as more beneficial in CBA analysis, it leaves the public purse, and ultimately taxpayers, picking up the bill for damages that occur, and is arguably distributionally unfair in this sense, as people who play no part in the problem do pay a share of the bill.

### **Negative distributional impacts of a ban or EPR scheme for single-use barbecues**

Both a ban and an EPR scheme for single-use barbecues would likely have a disproportionate impact on low-income groups, families and individuals for whom permanent barbecues are too expensive to purchase and therefore not a realistic option. It is clear the costs and risks from the use of single-use barbecues are much greater than those of permanent barbecues, but by introducing regulation on single-use but not permanent barbecues, this would likely have an adverse distributional effect.

## **7.2 Opportunities for Improving Data**

As discussed previously, the outputs of the model can only be as good as the accuracy of the data. This study was made challenging because in many cases the data itself was subject to considerable uncertainty. Whilst there is scope for improvement in the reliability of the majority of data used in the study, this section outlines two areas that would benefit, in particular, and how this might be achieved. These are fire science data collection, and sales data for sky lanterns.

### **7.2.1 Improved Fire Science**

One significant finding from this study during the research phase was a lack of confidence among key stakeholders in fire data, specifically evidence on causes of ignition. These concerns are shared by the Forestry Commission, which is the current repository of all wildfire data for England. Likewise, the Forestry Commission shares concerns about the lack of evidence on the costs these fires impose on society and the environment.

With fire risk identified as a major concern for single-use barbecues and sky lanterns, and a likely key rationale for any future regulation, this gap may become more pressing over time, especially if the UK, due to climate change, becomes a country where wildfire prevention becomes an ever more pressing policy question. The Forestry Commission has identified a need to grow capability and capacity, potentially learning from countries where fire risks are more embedded in data collection and policy making. The ability of investigators to identify the cause of

ignition, as well as better observation and analysis of on the ground impacts would both be valuable, and the Forestry Commission has recently received some funding for the latter. Nonetheless, they estimate creating a robust evidence base will require several years of additional research. The Forestry Commission is highly supportive of the need for the development of a Wildfire Strategy and Action Plan for England, of which data improvement would be a key component. [35]

## 7.2.2 Sky Lantern Sales Data

Sales data is central to any cost-benefit analysis and determining the extent of the impact of an item. Determining accurate figures for the study for this item was a particular challenge compared to the other two items. All major retailers are online-based and operate independently, so retailers have little knowledge of the market outside their own business, and the industry also lacks a trade representative or trade body. The challenge is compounded by the fact that a multitude of minor independents now operate in this sector, selling on third party platforms. No central product sales data is tracked by market intelligence services, partly due to the inconsistent classification of these items.

Defra's 2013 report did conduct interviews with three separate retailers to determine an estimate and still arrived at a very broad range estimate. For the current study, while it was possible to obtain an estimate of sales trends since 2013, the overall size of the market remains highly uncertain. This report has perhaps helped close some of the gaps between widely reported use and littering rates and estimated sales (see Section 3.2.2), but overall, this remains a market that lacks clear data sources on either sales or release. More accurate sales data might lead to a revision of some estimates in the current report and would undoubtedly be highly desirable to inform future policy decisions.

Data could perhaps be obtained via a small, targeted study, though given the challenges encountered for the current study, this might be hard without extensive stakeholder buy-in. Alternatively, a requirement for sales reporting might be necessary to get a better picture, though given the high proportion of online sales, many of them from outside the UK, and potentially from smaller sellers, the accuracy of such a sales reporting requirement might still be relatively poor.

## 7.3 Discussion and Further Policy Options

This section discusses policy options not assessed in the cost-benefit analysis policy appraisal. Many of the actions taken to date below national level are likely to have had an impact and should arguably be further supported.

**This study strongly suggests decisions by individual retailers to stop single-use barbecue sales if the risk is perceived to be high and is justified and proportionate.** This approach could be normalised (at national or local level) or formalised (for example with specific trigger points determined by Fire and Rescue Services). This approach is not however a panacea as while many single-use barbecue sales are doubtless opportunistic, it would also be possible to stockpile these items in advance of a temporary sales restriction, or to bring them in from beyond a localised sales restriction area. Long term restrictions on sales of sky lanterns by major retailers are likely to be a contributing factor in their reduced use over the past decade however, demonstrating ease of availability may well relate to ultimate use.

**Likewise, local controls on the use of barbecues, and releases of sky lanterns and helium balloons, are likely to have some effect, notwithstanding the challenges of enforcement.** Use bans are already possible using current powers, with a focus in this study on local authorities resorting to PSPOs. These controls are clearly seen as justified

in the areas deploying them and are likely to have a norm-setting effect for many in the population independently of enforcement. They can also be highly targeted to areas of concern that are determined locally. Mass release events for balloons may also be relatively easy for venues, public or private, to control. However, even for law-abiding citizens, awareness and understanding will be key, and it may be that UK citizens are relatively unaware of both rules and best practices relating to single-use barbecues and fires generally. In this context, local action is not a panacea. Enforcement can clearly be challenging, potentially costly, and may always be too little to create a significant deterrent or educational effect. Educational effects will be more limited by inconsistent regulations, or limited communications.

**Improved consumer labelling on risks and responsible use on-pack or at point of sale is desirable, though the impact is unproven. Improved safety labelling for responsible use has been pursued by some manufacturers directly, and the British Retail Consortium collectively, for single-use barbecues.** On-pack labelling may be a less effective route for other items (e.g., helium balloons will often be sold unpackaged) but in these cases, best practice guidance does still exist (e.g., Trading Standards Institute (sky lanterns), the Civil Aviation Authority, and trade bodies (balloons only)). This should be welcomed (where appropriate – “no release” guidance, rather than claims for “responsible release” should arguably be universal), but the impact is unproven for the moment.

**Making such guidelines and best practice mandatory may be worth consideration and might even be welcomed by responsible producers.** This option could be linked to the prospect of regulation – for example, bans or fees for products that are not deemed responsible.

**The combined impact of sales controls and use bans, changes to guidance, communication by NGOs, and perhaps increased public awareness of the issues may lie behind reductions in sky lantern use over the past decade.** The same could also apply to helium balloons, though increased costs for helium are also likely to be a factor. National policy changes could significantly improve consistency and public understanding in relation to all of these, and this may also have lessons for single-use barbecues.

**International experience suggests two additional options for helium balloons that were not modelled in this study. These include EPR and a requirement for sales to include a tether.** Some European countries are considering EPR (focused on end-of-life costs, including litter) for balloons. A pre-requisite is more detailed information on the extent of balloon litter. Such an EPR scheme would include awareness raising, specifically on the impacts of releasing helium balloons. The European Balloon and Party Council (EPBC) are working with the Dutch government to implement the policy in the Netherlands. An EPR scheme would also mean that improved data on these products would be made available. The tether requirement was found in California, where it is illegal to sell a helium balloon without it being attached to a weight to prevent it from leaving the ground. This would perhaps eliminate accidental release and might deter deliberate release, but it does not eliminate it. It may also create additional waste (in the form of the weight), so a careful assessment of costs and benefits would be needed before deciding this was a beneficial policy. These measures could be combined in practice if both were pursued (e.g., with a higher EPR fee for unweighted balloons).

**International experience also suggests that minimum standards for sky lanterns may reduce risks, but this may not solve the problem.** Design choices can reduce fire risk and reduce litter impacts (and associated animal welfare concerns), but they do not eliminate them. Choices include: making the paper flame retardant, not using wax fuel cells, use of pre-attached fiberglass strings to keep fuel cells in place, and not using a metallic frame. However, these choices are not unproblematic (e.g., fiberglass string is likely to pose wildlife risks, and while reduced littering is welcome, the use of these items always involves uncontrolled release without the prospect of retrieval). Nor would this approach eliminate risks associated with having these objects in the sky, whether from fire to aviation or



maritime safety, or in regard to spooking animals. It is notable however the Netherlands stepped back from a ban in favour of legalising lanterns with design changes.

**The EPR+ approach developed for this study – whether taken forward in regard to the full measures modelled here or not – is worth further development and consideration, for both the items in this study and more widely.** Conventional EPR is restricted to end-of-life costs, but the notion that producers should take responsibility for the wider negative impacts of the products they produce, especially when their design and marketing choices can directly affect the scale and nature of those impacts, should not be controversial, and may even be welcomed by more responsible providers. Such an approach ensures that the “polluter pays” and would transfer costs away from public agencies and the general taxpayer to the producers, and, through increased product prices, consumers. The approach to fire risk for example might apply to other products, such as cigarettes, that are often associated with fire risk.

# Appendices



# A 1.0 Glossary

Acronym	Description
ADAS	Independent agricultural and environmental consultancy (UK)
AONB	Areas of Outstanding Natural Beauty
BAPIA	Balloon and Party Industry Alliance
BHS	British Horse Society
CAA	Civil Aviation Authority
CBA	Cost-Benefit Analysis
CoP	Code of Practice
Defra	Department for Environment, Food and Rural Affairs
EBPC	European Balloon and Party Council
EPR	Extended Producer Responsibility
EWWF	England and Wales Wildfire Forum
FOD	Foreign Object Debris
FPN	Fixed Penalty Notice
FRS	Fire and Rescue Service
GSPR	General Safety and Performance Requirements
iBID	International Burn Injury Database
KBT	Keep Britain Tidy
MCS	Marine Conservation Society
MOR	Mandatory Occurrence Report
NABAS	National Association of Balloon Artists and Suppliers
NFU	National Farmers' Union
NGO	Non-governmental organisation
NPV	Net Present Value
OSPAR	Cooperation mechanism between the EU and 15 Governments to protect the North-East Atlantic marine environment. The name originates from the Oslo (OS) and Paris (PAR) Conventions.
PED	Price Elasticity of Demand
PSPO	Public Spaces Protection Order
RNLI	Royal National Lifeboat Institute
RSPCA	Royal Society for the Prevention of Cruelty to Animals
SAR	Search and Rescue
SSSI	Site of Special Scientific Interest
SUCB	Single-use carrier bags
WFU	Women's Food and Farming Union

# A 2.0 Methodology

The methodology for this study involved three distinct stages (summarised in **Figure A-1**). The first stage of the study involved gathering evidence of impacts for the three items, as well as what measures and interventions have been implemented, or are proposed to be implemented, to mitigate risk (both in England and internationally).

In order to gain a thorough understanding of the existing evidence base for sky lanterns and helium balloons, the project team began with a review of Defra’s 2013 report[11], produced by ADAS. Subsequent research focused on aspects not covered by this report, whether in terms of scope or time. Desk based research involved analysing a variety of sources including incident reports, media articles, academic papers and organisations’ position statements. Evidence that was gathered was recorded in a table with columns dividing sub-sets of themes under impacts, market data, measures and interventions, and public perception.

Engaging with stakeholders was a key element of the data gathering process, since data was often not readily publicly available, and provided important qualitative understanding of the issues. The project team engaged with stakeholders from a range of sectors, including Fire and Rescue Services, Local Government, NGOs, academic researchers, government agencies, trade bodies, nature reserves, trading standards institutes, manufacturers and retailers of the items. Stakeholders were prioritised into Tier 1 and Tier 2 stakeholders, according to a subjective *a priori* assessment of the likelihood they would have unique information, and the number of similar stakeholders that might also be approached. Tier 1 stakeholders were mainly interviewed online. Because different stakeholders had different specialist knowledge areas (i.e., knowledge of different items; knowledge regarding impacts; knowledge regarding market data; knowledge regarding impacts and measures), individual interview templates were produced for each stakeholder interviewed. Due to resource constraints, Tier 2 stakeholders were generally asked to fill out a tailored question sheet, although some Tier 2 stakeholders were also interviewed if it was subsequently decided that this would be most efficient. Indeed, the availability of specific stakeholders, and the number of stakeholders contacted and responding in different groups, led to a deliberately flexible approach in practice, with a focus on pursuing the most important evidence gaps. A full list of stakeholders can be seen in the Appendix (Section A 3.0).

Following the data gathering stage, four policy options were decided on amongst the project team to be taken forward to be modelled. These decisions were based on a relative assessment of impact for each item - and therefore which items, and steps to mitigate risks were appropriate - as well as feasibility. Modelling was carried out in Excel. In addition, a qualitative policy appraisal of measures that were not modelled was also undertaken. This was based on existing measures that have been implemented, or are being proposed to be implemented, in countries abroad, as well as discussions with relevant stakeholders. Findings from the desk-based research, stakeholder engagement, and modelling outputs were subsequently written up in report form.

**Figure A-1: Summary of method**



# A 3.0 Stakeholder Engagement

Stakeholders/Participants	Date	Type
Balloons and Party Industry Alliance (BAPIA)	18th November 2022	Interview
Brighton and Hove County Council - Head of Strategy at Brighton Council	25th November 2022	Interview
British Horse Society - Safety Department	17th November 2022	Written
British Retail Consortium	15th November 2022	Interview
Civil Aviation Authority	29th December 2022 - 19th January 2023	Written
Countryside Alliance	25th November 2022	Written
Dorset County Council	30th November 2022 (Interview)	Interview and written
England and Wales Wildfire Forum (EWFF)	23 <sup>rd</sup> November 2022	Interview
European Balloon and Party Council (EBPC)	24 <sup>th</sup> November 2022 (Interview)	Interview and written
Forestry Commission - Wildfire Advisor for Forestry Commission	28 <sup>th</sup> November 2022	Interview
Holkham Nature Reserve - Director	14 <sup>th</sup> November 2022	Interview
Home Office	1 <sup>st</sup> – 9 <sup>th</sup> December 2022	Written
International Burn Injury Database (iBID)	26 <sup>th</sup> October 2022 (Interview)	Interview and written
Keep Britain Tidy - staff member	2 <sup>nd</sup> December 2022 (Interview)	Interview and written
Local Government Association	23 <sup>rd</sup> November 2022	Interview
Marine Conservation Society UK (MCS) - staff member	15 <sup>th</sup> November 2022	Interview
Moorland Association	24 <sup>th</sup> November 2022	Written
National Farmers' Union (NFU)	16 <sup>th</sup> November 2022	Interview
National Fire Chiefs Council (NFCC) - Wildfire Lead/Chief Fire Officer at Northumberland Fire & Rescue	25 <sup>th</sup> November 2022	Interview
National Trust	18 <sup>th</sup> November 2022	Interview
Sky Lanterns Retailer	25 <sup>th</sup> November 2022 - 9 <sup>th</sup> January 2023	Written
North Norfolk District Council	17 <sup>th</sup> November 2022	Interview

Single-use Barbecue Manufacturer	24 <sup>th</sup> November 2022 (Interview)	Interview and written
Royal Society for the Prevention of Cruelty to Animals (RSPCA) – Wildlife Department	21 <sup>st</sup> November 2022	Interview
The National Gamekeepers' Organisation	3 <sup>rd</sup> December 2022	Written
Welsh Government	25 <sup>th</sup> November 2022	Written

Note: Some of the information from stakeholders has been presented anonymously to either ensure potentially commercially sensitive information is protected, or to respect concerns about confidentiality more widely.

## A 4.0 Average Numbers and Burn Areas for Wildfires in England

As outlined in Section 3.1.2.2, using wildfire data for the years 2009-2021 provided by the Forestry Commission[40, pp. 2020-21], the project team has extrapolated the middle-bound figure for the percentage of wildfires caused by barbecues (all types) from the limited sample dataset from Natural England's 2020 report[29]. Data has also been averaged to give numbers of wildfire and associated burn area, per year. The wildfire figures calculated to be caused by barbecues (all types) were reduced by 5% to estimate the number caused by *single-use barbecues only*. This data is presented in Table 3-2. The data for the average number and burn area for wildfires in England assumed to be caused by *all types* of barbecues is shown in the table below.

**Table A-1: Average numbers and burn areas for all wildfires, and those wildfires assumed to be caused by all types of barbecues per year**

	Average number of wildfires per year	Average burn area of wildfires per year	Average number of wildfires caused by barbecues per year	Average burn area of wildfires caused by barbecues per year
All land types	44,664	9182 ha	2,558	526 ha
Moorland	1,350	4573 ha	77	262 ha
Woodlands	5,350	669 ha	496	38 ha
Arable	10,004	2343 ha	573	134 ha
Built up areas and gardens	24,654	1597 ha	1,412	91 ha

Note: these figures are rounded.

# A 5.0 Local Authorities in England with Sky Lantern and Helium Balloon Release Ban

The list of English local authorities (LAs) from MCS[100] that have banned releases of sky lanterns, helium balloons, or both on their land is shown in **Table A-**. MCS relies on members of the public and councils to update them on any changes to this list and requires confirmation of a ban to add a local authority to the list. Therefore, this list may not be a comprehensive list of all local authorities with bans in place.

**Table A-2: MCS list of LAs in England who have banned releases [100]**

Both, sky lantern and balloon	Sky lantern only	Balloon only
Borough Council of King’s Lynn & West Norfolk	Bath & North East Somerset Council	Chorley Council
Braintree District Council	Calderdale Metropolitan Borough Council	Colchester Borough Council
Bude & Stratton Town Council	Essex County Council	Isle of Wight
Canterbury City Council	Herefordshire	Maldon District Council
Carlisle City Council	Lewisham Council	Redbridge Borough Council
Cheltenham Borough Council	New Forest District Council	Reigate and Banstead Borough Council
Chesham Town Council	West Berkshire Council	South Hams District Council
Cornwall County Council		South Tyneside Council
Devon County Council		Tonbridge & Malling Borough Council
Dover District Council		Torbay Council
Durham County Council		Windsor & Maidenhead Council
East Riding of Yorkshire Council		
East Suffolk Council		
Gateshead Council		
Gedling Borough Council		
Great Yarmouth Borough Council		
Gloucester City Council		
Hartlepool Borough Council		

Hertfordshire County Council		
Hinckley & Bosworth Borough Council		
Kirklees Council		
Lancaster City Council		
Lewes District Council		
Milton Keynes Council		
Newcastle City Council		
Norfolk County Council		
North Norfolk District Council		
Northumberland County Council		
Nottinghamshire County Council		
Oxford City Council		
Plymouth City Council		
Portsmouth City Council		
Rochford District Council		
Sedgemoor District Council		
Sefton Council		
Shropshire Council		
South Kesteven District Council		
South Ribble Borough Council		
Stockport Metropolitan Borough Council		
Sunderland City Council		
Swale Borough Council		
Swindon Borough Council		
Teignbridge District Council		
Tewkesbury Borough Council		
Thanet District Council		
West Oxfordshire District Council		
Wirral Council		
Worcestershire County Council		

The list of English local authorities (LAs) who have banned sky lanterns according to the NFU<sup>[123]</sup> is shown below.



**Table A-3: NFU list of LAs in England who have banned sky lanterns [123] in alphabetical order**

Sky lanterns banned		
A-F		
<ul style="list-style-type: none"> <li>• Amber Valley Borough Council</li> <li>• Arun District Council</li> <li>• Babergh District Council</li> <li>• Basildon Borough Council</li> <li>• Birmingham City Council</li> <li>• Bolton Borough Council</li> <li>• Bournemouth, Christchurch and Poole Council</li> <li>• Bracknell Forest Borough Council</li> <li>• Bradford City Council</li> <li>• Braintree District Council</li> <li>• Breckland District Council</li> <li>• Brighton and Hove District Council</li> <li>• Bristol City Council</li> <li>• Broadland District Council</li> <li>• Bromsgrove District Council</li> <li>• Broxbourne Council</li> </ul>	<ul style="list-style-type: none"> <li>• Calderdale Borough Council</li> <li>• Canterbury City Council</li> <li>• Carlisle City Council</li> <li>• Charnwood Borough Council</li> <li>• Chelmsford City Council</li> <li>• Cheltenham Borough Council</li> <li>• Chesham Town Council</li> <li>• Cheshire East Council</li> <li>• Cheshire West and Chester Council</li> <li>• Chichester District Council</li> <li>• City of Doncaster Council</li> <li>• Colchester Borough Council</li> <li>• Corby Borough Council</li> <li>• Cornwall Council</li> <li>• Crawley Borough Council</li> </ul>	<ul style="list-style-type: none"> <li>• Dacorum Borough Council</li> <li>• Derbyshire Dales District Council</li> <li>• Dover District Council</li> <li>• Dudley Borough Council</li> <li>• Ealing</li> <li>• East Cambridgeshire District Council</li> <li>• East Devon District Council</li> <li>• East Riding of Yorkshire Council</li> <li>• East Suffolk District Council</li> <li>• Eastleigh Borough Council</li> <li>• Eden District Council</li> <li>• Essex County Council</li> <li>• Fenland District Council</li> <li>• Folkestone &amp; Hythe District Council</li> <li>• Forest of Dean District Council</li> <li>• Fylde Borough Council</li> </ul>
G-R		
<ul style="list-style-type: none"> <li>• Gedling Borough Council</li> <li>• Gloucester City Council</li> <li>• Gosport Borough Council</li> <li>• Great Yarmouth Borough Council</li> <li>• Halton Borough Council</li> <li>• Hampshire County Council</li> <li>• Harrow Borough Council</li> <li>• Hartlepool Borough Council</li> <li>• Hastings Borough Council</li> <li>• Herefordshire Council</li> <li>• Hertfordshire County Council</li> <li>• High Peak Borough Council</li> <li>• Hinckley &amp; Bosworth Borough Council</li> <li>• Ipswich Borough Council</li> <li>• Ipswich Borough Council</li> <li>• Isle of Wight Council</li> <li>• Isles of Scilly</li> <li>• Kings Lynn &amp; West Norfolk Borough Council</li> <li>• Kirklees Borough Council</li> </ul>	<ul style="list-style-type: none"> <li>• Maidstone Borough Council</li> <li>• Maldon District Council</li> <li>• Malvern Hills District Council</li> <li>• Manchester County Council</li> <li>• Merton</li> <li>• Mid Devon District Council</li> <li>• Mid Suffolk District Council</li> <li>• Mid Sussex District Council</li> <li>• Milton Keynes Council</li> <li>• New Forest District Council</li> <li>• Newark &amp; Sherwood District Council</li> <li>• Norfolk County Council</li> <li>• North East Derbyshire District Council</li> <li>• North Hertfordshire District Council</li> <li>• North Norfolk District Council</li> <li>• North Somerset Council</li> <li>• North Yorkshire County Council</li> </ul>	<ul style="list-style-type: none"> <li>• Oldham Borough Council</li> <li>• Oxford City Council</li> <li>• Plymouth City Council</li> <li>• Portsmouth City Council</li> <li>• Preston City Council</li> <li>• Reading Borough Council</li> <li>• Redbridge</li> <li>• Redcar &amp; Cleveland Council</li> <li>• Reigate &amp; Banstead Borough Council</li> <li>• Richmondshire District Council</li> <li>• Rochdale Borough Council</li> <li>• Rochford District Council</li> <li>• Rother District Council</li> <li>• Rushcliffe Borough Council</li> <li>• Rutland County Council</li> </ul>

<ul style="list-style-type: none"> <li>• Lambeth</li> <li>• Lancaster City Council</li> <li>• Leeds City Council</li> <li>• Leicester City Council</li> <li>• Lewes District Council</li> <li>• Lewisham</li> <li>• Lincoln City Council</li> </ul>	<ul style="list-style-type: none"> <li>• Northumberland County Council</li> <li>• Norwich City Council</li> <li>• Nottinghamshire County Council</li> <li>• Nuneaton &amp; Bedworth Borough Council</li> </ul>	
<b>S-Z</b>		
<ul style="list-style-type: none"> <li>• Salford City Council</li> <li>• Sandwell Borough Council</li> <li>• Sedgemoor District Council</li> <li>• Selby District Council</li> <li>• Shropshire Council</li> <li>• Solihull Metropolitan Borough Council</li> <li>• Somerset West and Taunton Council</li> <li>• South Gloucestershire Council</li> <li>• South Hams District Council</li> <li>• South Holland District Council</li> <li>• South Kesteven District Council</li> <li>• South Lakeland District Council</li> <li>• South Norfolk County Council</li> <li>• South Oxfordshire District Council</li> <li>• South Tyneside Borough Council</li> <li>• Staffordshire Borough Council</li> <li>• Staffordshire County Council</li> <li>• Staffordshire Moorlands District Council</li> <li>• Stockport Borough Council</li> <li>• Suffolk Coastal District Council</li> <li>• Suffolk County Council</li> <li>• Sutton</li> <li>• Swale Borough Council</li> <li>• Swindon Borough Council</li> </ul>	<ul style="list-style-type: none"> <li>• Tameside Borough Council</li> <li>• Teignbridge District Council</li> <li>• Telford and Wrekin Council</li> <li>• Tendring Council</li> <li>• Tendring District Council</li> <li>• Test Valley Borough Council</li> <li>• Thanet District Council</li> <li>• Three Rivers District Council</li> <li>• Tonbridge &amp; Malling Borough Council</li> <li>• Torbay Council</li> <li>• Trafford Borough Council</li> <li>• Uttlesford District Council</li> <li>• Vale of White Horse District Council</li> </ul>	<ul style="list-style-type: none"> <li>• Wakefield City Council</li> <li>• Wandsworth</li> <li>• Warwick District Council</li> <li>• Warwickshire County Council</li> <li>• Waverley Borough Council</li> <li>• West Berkshire Council</li> <li>• West Devon Borough Council</li> <li>• West Lindsey District Council</li> <li>• West Oxfordshire District Council</li> <li>• Wigan Borough Council</li> <li>• Wiltshire Council</li> <li>• Winchester City Council</li> <li>• Windsor and Maidenhead Borough Council</li> <li>• Wirral Borough Council</li> <li>• Woking Borough Council</li> <li>• Wolverhampton City Council</li> <li>• Worcester City Council</li> <li>• Worcestershire County Council</li> <li>• Wychavon District Council</li> <li>• Wycombe District Council</li> <li>• Wyre Borough Council</li> <li>• Wyre Forest District Council</li> </ul>

# A 6.0 Further Modelling Information

## Additional basket spend (not used in the model)

This is based on UK barbecue organisation ‘National BBQ Week’ reporting that the average consumer spend on food for an (assumed permanent) barbecue was £44.05 in 2022<sup>[124]</sup>, and an associated downweighting for single-use barbecues. When considering what an approximate additional basket spend might be when a single-use barbecue is sold, one must first consider that a) less food can fit on a single-use barbecue, (particularly a non-party size), than on many permanent barbecues and b) the cooking time is shorter on single-use barbecues because less charcoal can also fit, and charcoal is not typically ‘topped up’. For these reasons, less food can be cooked on a single-use barbecue. The project team has made a conservative assumption that additional basket spend will be 50% less for a standard size single-use barbecue, and 25% less for a party size single-use barbecue. Based on stakeholder information Enumia also estimated that in 2022, party size barbecues represented 32% of sales and standard size single-use barbecues represented 68%, though the evidence for this split was limited to a single source. In this case additional basket spend for both party size and standard size single-use barbecues in the UK would be approximately £230 million per year.<sup>[113]</sup>

Note that “additional basket spend” may not be truly additional, in that consumers may well have spent the same amount of discretionary spend on other activities or products in the absence of a barbecue.

## Mandatory Occurrence Reports (MOR) – sky lanterns and balloons

Table A-4: Number of MORs from sky lanterns<sup>[82]</sup>

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sky lantern			2	1	2		1				1
Sky lantern on taxiway					1						1
Multiple lanterns	1						1				

**Table A-5: Number of MOR from balloons<sup>[82]</sup>**

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
<b>Balloon</b>	1	1	3	4	4	5	12	10	4	9	9
<b>Multiple balloons</b>				2	1	1		1		1	
<b>Helium balloon</b>						1	4	2		4	
<b>Multiple helium balloons</b>		1					2	3			
<b>Balloon in the engine</b>						1					
<b>Balloon near runway area</b>						1	1				
<b>Balloon on runway area</b>					1			1	2	13	19
<b>Drone/balloon*</b>				6	15	20	22	18	8	15	10
<b>Possible balloon</b>				2	4	4	1	4	1	3	1
<b>Total</b>	1	2	3	14	25	33	42	39	15	45	39

\* The wider use of drones (since 2016) has increased the number of reports where the reporter is not clear whether the sighted object was a balloon or a drone

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