



## Impact of Air and Water Pollution on the Environment and Public Health Debate on 26 October 2017

### Summary

On 26 October 2017, the House of Lords is due to debate a motion, moved by Baroness Miller of Chilthorne Domer (Liberal Democrat), that “this House takes note of the impact of air and water pollution on the environment and public health”.

Air pollution is caused by a number of sources and human activities—such as industry and transport—and can have a detrimental effect on public health and the environment. Air pollution is said to be a problem at the local, national and international levels. Air quality in the UK is largely governed by the EU’s Ambient Air Quality Directive (2008/50/EC). This Directive sets legally binding limits for concentrations in outdoor air of major air pollutants that impact public health, such as particulate matter and nitrogen dioxide. In February 2017, the European Commission gave the UK a final warning over its failure to meet air pollution limits for nitrogen dioxide. In July 2017, the Government published its air quality plan. Along with £2.7 billion committed to improving overall air quality and cleaner transport, the plan required local authorities to develop their own plans to reduce air pollution in their areas.

Water pollution is caused by both synthetic and biological contaminants, and can, amongst other things, be damaging for aquatic environments. For example, organic matter that decomposes in water can reduce its oxygen content, resulting in potentially harmful effects for organisms such as fish. Likewise, nitrates used in agriculture can cause algae growth—known as an ‘algal bloom’—which can harm the aquatic environment by reducing the amount of sunlight reaching underwater plants, therefore disrupting the ecosystem.

The EU’s Water Framework Directive (WFD)—adopted in 2000—governs most work in managing and protecting water bodies in the UK. The WFD is based on natural geographical and hydrological units. Under the Directive, member states are required to achieve a ‘good’ status for all bodies of surface water and groundwater by 2015 or 2027. In addition, EU’s Marine Strategy Framework Directive (2008/56/EC) aims to achieve good environmental status (GES) of the EU’s marine waters by 2020. The Joint Nature Conservation Committee (JNCC)—a public body that advises the Government on nature conservation—has reported that the number of water bodies awarded high or good surface water status between 2011 and 2016 decreased from 37 percent in 2011 to 35 percent in 2016.

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## 1. Impact of Air Pollution on Public Health

### 1.1 Causes of Air Pollution

According to the Department for Environment, Food and Rural Affairs, air pollution is “caused by the emission of pollutants, which either directly or through chemical reactions in the atmosphere lead to negative impacts on human health and ecosystems”.<sup>1</sup> It is caused by a number of human activities, such as power stations, transport, household heating, agriculture and industrial processes.<sup>2</sup> Air pollution can have a significant impact on public health and the environment and is a problem at a local, national and international level.<sup>3</sup> Historically, air pollution was caused by high levels of smoke and sulphur dioxide as a result of the burning of fossil fuels, such as coal, for domestic and industrial purposes.<sup>4</sup> However, the Department for Environment, Food and Rural Affairs (DEFRA) observes that, today, the “major threat to clean air is now posed by traffic emissions”, especially from petrol and diesel vehicles.<sup>5</sup> These vehicles emit a number of pollutants, such as carbon monoxide (CO), oxides of nitrogen (NO<sub>x</sub>), volatile organic compounds (VOCs) and particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>). Moreover, sunlight causes a reaction in nitrogen dioxide (NO<sub>2</sub>) and VOCs to create ozone (O<sub>3</sub>)—a secondary pollutant. This reaction takes place over time and ozone may be found far away from the original source of the emissions.<sup>6</sup>

### 1.2 Key Legislation

Air quality in the UK is largely governed by the EU’s Ambient Air Quality Directive (2008/50/EC). This Directive sets legally binding limits for concentrations in outdoor air of major air pollutants that impact public health, such as particulate matter and NO<sub>2</sub>.<sup>7</sup> In England, the Air Quality Directive has effect through the Air Quality Standards Regulations 2010. These also incorporate the Fourth Air Quality Daughter Directive (2004/107/EC) which sets limits in outdoor air for a number of toxic heavy metals. As air quality is a devolved matter, separate legislation exists in Scotland, Wales and Northern Ireland.<sup>8</sup> Under the Greater London Authority Act 1999, the Mayor of London is required to produce an air quality strategy setting out proposals for the implementation in London of the national air quality strategy and for achieving air quality standards

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<sup>1</sup> Department for Environment, Food and Rural Affairs, [Emissions of Air Pollutants in the UK, 1970 to 2015](#), 21 December 2016, p 3.

<sup>2</sup> *ibid.*

<sup>3</sup> National Atmospheric Emissions Inventory, [Overview of Air Pollutants](#), 16 October 2016.

<sup>4</sup> Department for Environment, Food and Rural Affairs, [Causes of Air Pollution](#), accessed 16 October 2017.

<sup>5</sup> *ibid.*

<sup>6</sup> Department for Environment, Food and Rural Affairs, [What Are the Causes of Air Pollution?](#), accessed 18 October 2017, pp 2–3.

<sup>7</sup> Department for Environment, Food and Rural Affairs, [UK and EU Air Quality Policy Context](#), 14 February 2011.

<sup>8</sup> *ibid.*

prescribed in regulations.<sup>9</sup>

With regards to transboundary air pollution, the Gothenburg Protocol to the United Nations Economic Commission for Europe's (UNECE) Convention on Long Range Transboundary Air Pollution (CLRTAP) was signed in 1979 and came into force in 1983. According to the UNECE, the Convention laid down general principles of international cooperation for air pollution abatement and set up an institutional framework for research and policy.<sup>10</sup> Its protocols set national emission ceiling limits for a number of pollutants such as nitrogen oxides. Similar emission ceilings were incorporated into EU law in 2001 under the National Emission Ceilings Directive (2001/81/EC) and in UK law as the National Emission Ceilings Regulations 2002.<sup>11</sup>

### 1.3 Air Quality in the UK

Air quality in the UK has improved significantly over a number of decades. Emission levels have fallen and now—with the exception of NO<sub>2</sub>—fall within legal limits.<sup>12</sup> However, emissions continue to pose a risk to public health and can damage the environment. A recent BBC News article observed that there has been increasing concern about air quality because, firstly, “experts in air pollution argue that it has been under-reported for decades” and, secondly, the UK Government had lost a number of court cases over its plans to cut emissions.<sup>13</sup> In addition, diesel vehicles have received criticism recently as they are said to “produce the overwhelming majority of nitrogen oxide gases coming from roadside sources” and because of reports that carmakers have been found to be “cheating” emissions tests.<sup>14</sup> The problem of air pollution is particularly acute in urban areas. It has been reported that “in many big UK cities safe limits on harmful particulates and oxides of nitrogen—NO<sub>x</sub>—are still regularly breached”.<sup>15</sup> In January 2017, the *Guardian* reported findings by Londonair—a website provided by the Environmental Research Group of King's College London that shows air pollution in London and south east England—that London breached its annual air pollution limits just five days into the start of 2017 in Brixton Road in south London.<sup>16</sup>

<sup>9</sup> Greater London Authority Act 1999, s 362. For more detail about London, see: House of Lords Library, [Air Quality in London](#), 28 June 2017.

<sup>10</sup> United Nations Economic Commission for Europe, [The Convention and its Achievements](#), accessed 16 October 2017.

<sup>11</sup> Department for Environment, Food and Rural Affairs, [Food and Rural Affairs, UK and EU Air Quality Policy Context](#), 14 February 2011.

<sup>12</sup> House of Commons Environment, Food and Rural Affairs Committee, [Air Quality](#), 27 April 2016, HC 479 of session 2015–16, p 5.

<sup>13</sup> BBC News, [How Bad is Air Pollution in the UK?](#), 6 March 2017; and [Volkswagen: The Scandal Explained](#), 10 December 2015.

<sup>14</sup> BBC News, [Petrol and Diesel Ban: How Will it Work?](#), 26 July 2017; and [Volkswagen: The Scandal Explained](#), 10 December 2015.

<sup>15</sup> BBC News, [How Bad is Air Pollution in the UK?](#), 6 March 2017.

<sup>16</sup> *Guardian*, [London Breaches Annual Air Pollution Limit for 2017 in Just Five Days](#), 6 January 2017.

As part of its compliance with EU air quality legislation, the UK is divided into 43 zones for the purposes of monitoring air pollution. In 2016, the Department for Environment, Food and Rural Affairs (DEFRA) found that only six zones were compliant with the annual mean limit value for NO<sub>2</sub> concentrations of 40 µg m<sup>-3</sup> (microgram per cubic metre). These were:

- Brighton/Worthing/Littlehampton
- Blackpool Urban Area
- Preston Urban Area
- Highland
- Scottish Borders
- Northern Ireland.<sup>17</sup>

The remaining 37 zones exceeded this limit value.<sup>18</sup> Two zones—the Greater London Urban Area and South Wales—exceeded the one hour mean NO<sub>2</sub> limit value of 200 µg m<sup>-3</sup> on 18 occasions during 2016.<sup>19</sup> The remaining 41 zones complied with this limit.<sup>20</sup>

With regards to other pollutants, DEFRA has summarised the UK's compliance with EU emission targets as follows:

- Four zones exceeded the target value for benzo[a]pyrene (a group of compounds called polycyclic aromatic hydrocarbons).
- Three zones exceeded the target value for nickel.
- All zones met both the target values for ozone; the target value based on the maximum daily eight-hour mean, and the target value based on the [AOT40](#) statistic.
- All zones except one exceeded the long-term objective for ozone, set for the protection of human health. This is based on the maximum daily eight-hour mean.
- Five zones exceeded the long-term objective for ozone, set for the protection of vegetation. This is based on the AOT40 statistic.
- All zones met the limit value for daily mean concentration of PM<sub>10</sub> particulate matter, without the need for subtraction of the contribution from natural sources.
- All zones met the limit value for annual mean concentration of PM<sub>10</sub> particulate matter, without the need for subtraction of the contribution from natural sources.

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<sup>17</sup> Department for Environment, Food and Rural Affairs, [Air Pollution in the UK 2016](#), September 2017, p 42.

<sup>18</sup> *ibid.*

<sup>19</sup> *ibid.*

<sup>20</sup> *ibid.*

- All zones met the target value for annual mean concentration of PM<sub>2.5</sub> particulate matter, the Stage 1 limit value, which came into force on 1 January 2015, and the Stage 2 limit value which must be met by 2020.
- All zones met the EU limit values for sulphur dioxide, carbon monoxide, lead and benzene.<sup>21</sup>

In February 2017, the European Commission issued a final warning to the UK Government (as well as Germany, France, Spain and Italy) to comply with EU air pollution limits for NO<sub>2</sub>.<sup>22</sup> The compliance deadline for NO<sub>2</sub> emissions was 2010, and under EU rules, when emission levels are breached, a member state must implement air quality plans to bring the levels back down.<sup>23</sup> The European Commission stated that there had been persistent breaches in NO<sub>2</sub> levels in 16 of the UK's air quality zones, among them London, Birmingham, Leeds and Glasgow.<sup>24</sup> More recently, in September 2017, the United Nations Special Rapporteur on Human Rights Related to Toxic Waste, Baskut Tuncak, accused the UK Government of “flouting” its duty to protect UK citizens from dangerous levels of air pollution.<sup>25</sup>

#### 1.4 Health Impact

The World Health Organisation (WHO) has stated that “[o]utdoor air pollution is a major environmental health problem affecting everyone in developed and developing countries alike”.<sup>26</sup> The WHO argues that by reducing air pollution levels “countries can reduce the burden of disease from stroke, heart disease, lung cancer, and both chronic and acute respiratory diseases, including asthma”.<sup>27</sup> It estimated that air pollution caused 3 million premature deaths worldwide in 2012.<sup>28</sup> The WHO has published air quality guidelines which seek to reduce the health impacts of air pollution. These were first published in 1987, revised in 1997 and updated in 2005 to reflect new evidence on the health effects of particulate matter (PM), ozone (O<sub>3</sub>), nitrogen dioxide (NO<sub>2</sub>) and sulphur dioxide (SO<sub>2</sub>).<sup>29</sup> The guidelines set thresholds and limits to key air pollution

<sup>21</sup> Department for Environment, Food and Rural Affairs, [Air Pollution in the UK 2016](#), September 2017, pp iii–iv.

<sup>22</sup> Arthur Neslen, ‘[European Commission Issues ‘Final Warning to UK Over Air Pollution Breaches’](#)’, *Guardian*, 15 February 2017; and European Commission, ‘[Commission Warns Germany, France, Spain, Italy and the United Kingdom of Continued Air Pollution Breaches](#)’, 15 February 2017.

<sup>23</sup> BBC News, ‘[Air Pollution ‘Final Warning’ From European Commission to UK](#)’, 15 February 2017.

<sup>24</sup> European Commission, ‘[Commission Warns Germany, France, Spain, Italy and the United Kingdom of Continued Air Pollution Breaches](#)’, 15 February 2017.

<sup>25</sup> Damian Carrington, ‘[Britain Flouting Duty to Protect Citizens from Toxic Air Pollution—UN](#)’, *Guardian*, 10 September 2017.

<sup>26</sup> World Health Organisation, ‘[Ambient \(Outdoor\) Air Quality and Health](#)’, September 2016.

<sup>27</sup> *ibid.*

<sup>28</sup> *ibid.*

<sup>29</sup> World Health Organisation, [Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulphur Dioxide: Global Update 2005 Summary of Risk Assessment](#), 2006, p 5.

components that pose health risks.

The WHO's International Agency for Research on Cancer concluded that "outdoor air pollution is carcinogenic to humans".<sup>30</sup> This was attributed to particulate matter in air pollution, which was "most closely associated with increased cancer incidence, especially cancer of the lung".<sup>31</sup> The WHO guidelines suggest that by "reducing particulate matter (PM<sub>10</sub>) pollution from 70 to 20 micrograms per cubic metre ( $\mu$  g/m) [...] air pollution-related deaths [can be cut] by around 15 percent".<sup>32</sup>

In February 2016, the Royal College of Physicians (RCP) and the Royal College of Paediatrics and Child Health (RCPC) estimated the impact of air pollution on the health in the UK. They found that around 40,000 deaths were "attributable to exposure to outdoor air pollution, with more linked also to exposure to indoor pollutants".<sup>33</sup> The report argued that the damage to health from pollution occurs across a lifetime. It suggested that "gestation, infancy and early childhood are vulnerable times because the young body is growing and developing rapidly".<sup>34</sup> Likewise, older people and adults with long-term health conditions were also more vulnerable to air pollution. Further, the report observed that while air pollution was harmful to everybody, certain groups are particularly affected because they:

- Live in deprived areas, which often have higher levels of air pollution;
- live, learn or work near busy roads; and
- are more vulnerable because of their age or existing medical conditions.<sup>35</sup>

The report estimated that the health problems associated with air pollution costs the UK more than £20 billion every year.<sup>36</sup> It argued that "neither the concentration limits set by government, nor the World Health Organization's air quality guidelines, define levels of exposure that are entirely safe for the whole population".<sup>37</sup>

In October 2017, the Lancet Commission on Pollution and Health published its findings. It reported that "diseases caused by pollution were responsible for an estimated 9 million premature deaths in 2015—16 percent of all deaths worldwide".<sup>38</sup> Moreover, the Commission stated that "welfare losses

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<sup>30</sup> World Health Organisation, '[Ambient \(Outdoor\) Air Quality and Health](#)', September 2016.

<sup>31</sup> *ibid.*

<sup>32</sup> *ibid.*

<sup>33</sup> Royal College of Physicians and Royal College of Paediatrics and Child Health, '[Every Breath We Take: The Lifelong Impact of Air Pollution](#)', February 2016, p xii.

<sup>34</sup> *ibid.*

<sup>35</sup> *ibid.*, p xiii.

<sup>36</sup> *ibid.*

<sup>37</sup> *ibid.*, p xii.

<sup>38</sup> *Lancet*, '[Commission on Pollution and Health](#)', 19 October 2017, p 1.

due to pollution are estimated to amount to US\$4.6 trillion per year: 6.2 percent of global economic output”.<sup>39</sup> The Commission found that the UK has the third highest rate of pollution deaths in Western Europe and 50,000 deaths could be attributed to the impact of traffic fumes.<sup>40</sup>

### 1.5 Impact of Air Pollution on the Environment

In addition to the impact on health, air pollution can also damage the environment and ecosystems. DEFRA has observed that air pollution can cause such damage through the following:

- **Acidification** (SO<sub>2</sub>, NO<sub>x</sub> and NH<sub>3</sub>)—where chemical reactions involving air pollutants create acidic compounds which when deposited on land and aquatic systems can cause harm to soils, vegetation and buildings.
- **Eutrophication** (NO<sub>x</sub> and NH<sub>3</sub>)—where nitrogen can be deposited in soils or in rivers and lakes through rain, affecting the nutrient levels and diversity of species in sensitive environments, for example encouraging algae growth in lakes and water courses.
- **Ground-level ozone** (NO<sub>x</sub> and NMVOCs)—where chemical reactions involving NO<sub>x</sub> and NMVOCs produce the toxic gas ozone (O<sub>3</sub>) which can damage wild plants, crops, forests and some materials and is a greenhouse gas contributing to the warming of the atmosphere.<sup>41</sup>

Moreover, pollutants can be transported by weather systems, which means they can have a harmful impact elsewhere.

### 1.6 Climate Change

Climate change is caused by the release of greenhouse gases through human activity, such as industry and agriculture.<sup>42</sup> Greenhouse gases include carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O) and fluorinated gases. The Committee on Climate Change—an independent statutory body established by the Climate Change Act 2008 to advise the UK Government on emissions targets—provides that:

Since the late 19th century, the global average temperature has risen by about 1C and the global sea level has risen by about 20cm. The rising temperature is leading to wider changes to our weather. At the

<sup>39</sup> *Lancet*, [Commission on Pollution and Health](#), 19 October 2017, p 1.

<sup>40</sup> *Times* (£), [‘Diesel Fumes Make British Streets among Most Toxic in West’](#), 20 October 2017.

<sup>41</sup> Department for Environment, Food and Rural Affairs, [Emissions of Air Pollutants in the UK, 1970 to 2015](#), 21 December 2016, p 4.

<sup>42</sup> Committee on Climate Change, [‘Tackling Climate Change’](#), accessed 19 October 2017.

same time, increased CO<sub>2</sub> levels are causing the world's oceans to become more acidic.<sup>43</sup>

Moreover, the Committee argues that:

There is no clear threshold where climate change moves from safe to dangerous. We can expect some disruptions and irreversible losses of natural habitats and resources, even with a 2C temperature rise.<sup>44</sup>

Climate change is having, and is predicted to have, a number of harmful effects such as extreme weather events; declining glaciers and sea ice, rising sea levels; the bleaching of coral reefs (from increasingly acidic oceans); the slowing of increases to crop productivity; and severe impacts on the world's poorest and most vulnerable populations.<sup>45</sup>

### 1.7 Government Policy on Air Pollution in the UK

On 26 July 2017, the Government published its plan for tackling roadside NO<sub>2</sub> concentrations in the UK.<sup>46</sup> Both the UK Government and the devolved administrations have policy responsibility for air quality, but responsibility for air quality evidence is UK-wide.<sup>47</sup> The plan stated that the “UK Government and the devolved administrations support local authorities and public transport providers via central guidance and access to various grant funding schemes described [...]”.<sup>48</sup>

The *Financial Times*' environment correspondent, Pilita Clerk, has observed that the “basic problem the Government is trying to address is diesel vehicles, which are a significant source of toxic nitrogen dioxide linked to lung and heart disease”.<sup>49</sup> In order to improve air quality, the Government announced that the sale of new cars with petrol or diesel engines will be banned from 2040 (France made a similar announcement earlier in July 2017).<sup>50</sup> The air quality plan stated that the Government had already committed to investing over £2.7 billion overall in air quality and cleaner transport.<sup>51</sup> This included: a £1 billion investment in ultra-low emission

<sup>43</sup> Committee on Climate Change. [‘The Science and Impacts of Climate Change’](#), accessed 19 October 2017.

<sup>44</sup> *ibid.*

<sup>45</sup> *ibid.*; and [‘How a Changing Climate Affects Us’](#), accessed 20 October 2017.

<sup>46</sup> Department for Environment, Food and Rural Affairs and Department for Transport, [UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations: An Overview](#), July 2017.

<sup>47</sup> *ibid.*, p 11; and [Technical Report](#), July 2017, p 30.

<sup>48</sup> Department for Environment, Food and Rural Affairs and Department for Transport, [UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations: Detailed Plan](#), July 2017, p 11.

<sup>49</sup> Pilita Clark, [‘Does the UK Plan to Tackle Air Pollution Stack Up?’](#), *Financial Times* (£), 26 July 2017.

<sup>50</sup> Jim Pickard and Peter Campbell, [‘UK Plans to Ban Sale of New Petrol and Diesel Cars by 2040’](#), *Financial Times* (£), 26 July 2017; and Angelique Chrisafis and Adam Vaughan, [‘France to Ban Sales of Petrol and Diesel Cars by 2040’](#), *Guardian*, 6 July 2017.

<sup>51</sup> Department for Environment, Food and Rural Affairs and Department for Transport, [UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations: An Overview](#), July 2017, p 4.

vehicles (ULEVs) and charging infrastructure; £290 million from the National Productivity Investment Fund to reduce transport emissions; £11 million to the Air Quality Grant scheme (which provides funding for local authority projects to improve air quality); and £1.2 billion to invest in the promotion of cycling and walking. Other measures included pledges to fund cleaner buses and to improve air quality on the national road network.<sup>52</sup>

The Government stated that air quality improvements should be driven by local government and each local authority had been asked to develop initial plans to tackle air pollution in their area, and final plans within the year.<sup>53</sup> As part of this, the Government will set up a £255 million implementation fund to “support local authorities to prepare their plans and deliver target action to improve air quality”.<sup>54</sup> In addition, the Government will establish a Clean Air Fund which will “will allow local authorities to bid for additional money to support the implementation of measures to improve air quality”.<sup>55</sup> The plan also reiterated the 2016 Autumn Statement announcement of £100 million for retrofitting and new low emission buses.<sup>56</sup>

In July 2016, the Mayor of London, Sadiq Khan, launched a consultation on improving air quality.<sup>57</sup> On 23 October, following this consultation, a £10 emissions surcharge (known as the ‘T-charge’) came into force. This requires “older vehicles driving in central London [...] to meet minimum Euro emission standards or pay an extra daily charge”.<sup>58</sup> Twelve ‘Low Emission Bus Zones’, in which all but the least polluting buses will be banned, were also announced by the Mayor.<sup>59</sup> The first zone was introduced along Putney High Street in March 2017 and will be followed by an area between Streatham and Brixton in autumn 2017.<sup>60</sup> The remaining ten are expected to be delivered by 2020. The Mayor also proposed bringing forward the introduction of the Ultra Low Emission Zone (ULEZ) from 2020 to 2019 and strengthening the emissions standard of the ULEZ to cover particulate matter; a consultation on this proposal closed on 25 June 2017.

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<sup>52</sup> Department for Environment, Food and Rural Affairs and Department for Transport, [UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations: An Overview](#), July 2017, pp 4–5.

<sup>53</sup> Department for Environment for Environment, Food and Rural Affairs and Department for Transport, [‘Plan for Roadside NO2 Concentrations Published’](#), 26 July 2017.

<sup>54</sup> Department for Environment, Food and Rural Affairs and Department for Transport, [UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations: An Overview](#), July 2017, pp 4–5.

<sup>55</sup> *ibid.*

<sup>56</sup> *ibid.*

<sup>57</sup> Mayor of London, [‘Sadiq Khan Unveils Action Plan to Battle London’s Toxic Air’](#), 5 July 2016.

<sup>58</sup> Transport for London, [‘T-Charge’](#), accessed 23 October 2017.

<sup>59</sup> Mayor of London, [‘Mayor: £10 “Toxicity Charge” for Most Polluting Cars Starts October 23’](#), 17 February 2017; and [‘Sadiq Khan Announces 10 New Low Emission Bus Zones to Tackle Toxic Air’](#), 6 January 2017.

<sup>60</sup> Transport for London, [‘Improving Buses’](#), accessed 23 October 2017.

## **ClientEarth**

The environment charity, ClientEarth has taken the Government to court on a number of occasions over its plans to tackle emissions. In April 2015, the Supreme Court ruled that the Coalition Government was in breach of its obligations to bring emissions within EU limits and was ordered to publish a new air quality plan.<sup>61</sup> The Government subsequently published [Improving Air Quality in the UK: Tackling Nitrogen Dioxide in Our Towns and Cities](#), which proposed the introduction of clean air zones in urban areas.<sup>62</sup> However, ClientEarth argued that this plan was inadequate, as emissions in parts of the UK would still breach EU limits. In 2016, ClientEarth sought a judicial review and the High Court ruled that the Government should come up with a new plan.<sup>63</sup> The draft plan was published in May 2017.

ClientEarth took the Government to court again in July 2017 over its draft air quality plan, which the group considered defective.<sup>64</sup> The group argued that the Government's own technical documents showed that setting up chargeable clean air zones was the best way to tackle air pollution. However, the Government's draft document stated measures other than charging zones should be preferred.<sup>65</sup> The High Court rejected ClientEarth's claim, stating that they were based on a draft plan that could change in the future.<sup>66</sup>

In response to the Government's July 2017 air quality plan, the CEO of Client Earth, James Thornton, argued that

On our initial examination, this is little more than a shabby rewrite of the previous draft plans and is underwhelming and lacking in urgency.

[...]

This plan is, yet again, a plan for more plans. The Government is passing the buck to local authorities to come up with their own schemes as an alternative to clean air zones which charge the most polluting vehicles to enter our towns and cities.<sup>67</sup>

<sup>61</sup> BBC News, ['Court Orders UK to Cut NO2 Air Pollution'](#), 29 April 2015.

<sup>62</sup> Department for Environment, Food and Rural Affairs, [Improving Air Quality in the UK: Tackling Nitrogen Dioxide in Our Towns and Cities](#), December 2015, p i.

<sup>63</sup> Pilita Clark, ['Court Rejects Challenge to UK Anti-Pollution Plan'](#), *Financial Times* (£), 5 July 2017.

<sup>64</sup> *ibid*; and Department for Environment, Food and Rural Affairs and Department for Transport, [Improving Air Quality in the UK: Tackling Nitrogen Dioxide in Our Towns and Cities: Draft UK Air Quality Plan for Tackling Nitrogen Dioxide](#), May 2017.

<sup>65</sup> Pilita Clark, ['Court Rejects Challenge to UK Anti-Pollution Plan'](#), *Financial Times* (£), 5 July 2017.

<sup>66</sup> *ibid*.

<sup>67</sup> ClientEarth, ['Gove Falls at First Hurdle on Air Pollution Say Environmental Lawyers'](#), 26 July 2017.

The plan also received criticism from the Chief Executive of the Society of Motor Manufacturers and Traders, Mike Hawes. He argued that an outright ban of petrol and diesel vehicles could undermine the industry, as demand from alternatively fuelled vehicles was still at a low level.<sup>68</sup>

A number of stakeholders criticised the absence of a diesel scrappage scheme in the plan. The leaders of Liverpool, Leeds, Birmingham, Southampton and Oxford city councils wrote to the Environment Secretary, Michael Gove, calling for legislation to introduce a diesel scrappage scheme.<sup>69</sup>

## 2. Water Pollution: Causes and Impacts

Water pollution occurs when contaminants enter water bodies such as lakes, rivers and oceans.<sup>70</sup> Water sources can be contaminated by a large number of different substances, both synthetic and biological. In the case of freshwater bodies (such as rivers), *National Geographic* has observed that they can contain traces of “contaminants ranging from birth control pills and sunscreen to pesticides and petroleum, our planet’s lakes, rivers, streams, and groundwater are often a chemical cocktail”.<sup>71</sup> In terms of biological contaminants, *National Geographic* has noted that “freshwater is also the end point for biological waste, in the form of human sewage, animal excrement, and rainwater runoff flavoured by nutrient-rich fertilizers from yards and farms”.<sup>72</sup> These contaminants can be transported into the ocean by rivers, spreading the pollution further. In terms of marine pollution, the *National Geographic* has observed that:

Common man-made pollutants that reach the ocean include pesticides, herbicides, chemical fertilizers, detergents, oil, sewage, plastics, and other solids. Many of these pollutants collect at the ocean’s depths, where they are consumed by small marine organisms and introduced into the global food chain. Scientists are even discovering that pharmaceuticals ingested by humans but not fully processed by our bodies are eventually ending up in the fish we eat.<sup>73</sup>

### 2.1 Freshwater

Freshwater bodies generally comprise groundwater (water below Earth’s surface) and surface water (such as rivers or lakes) and pollution can effect these in a number of ways. Pollution in groundwater can be particularly

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<sup>68</sup> Jim Pickard and Peter Campbell, ‘[UK Plans to Ban Sale of New Petrol and Diesel Cars by 2040](#)’, *Financial Times* (£), 26 July 2017.

<sup>69</sup> Rowena Mason and Damian Carrington, ‘[Government’s Air Quality Plan Branded Inadequate By City Leaders](#)’, *Guardian*, 26 July 2017.

<sup>70</sup> World Wildlife Fund, ‘[Water Pollution](#)’, accessed 19 October 2017.

<sup>71</sup> *National Geographic*, ‘[Water Pollution](#)’, accessed 18 October 2017.

<sup>72</sup> *ibid.*

<sup>73</sup> *National Geographic*, ‘[Marine Pollution](#)’, 27 April 2010.

problematic as it is difficult to detect and clean up.<sup>74</sup> Untreated sewage and nitrates from agricultural chemicals are the most common types of groundwater pollutants, and they can also be affected by harmful chemicals from things like landfills and toxic waste plants.<sup>75</sup> To a certain extent, rivers can clean themselves of pollution by flushing contaminants downstream.<sup>76</sup> The contamination of lakes is much more problematic, as water generally remains within the lake, pollutants can linger for a long time.<sup>77</sup>

There are two types of pollution sources. A 'point source' is an identifiable source from which pollutants are discharged and these can generally be controlled easily.<sup>78</sup> In contrast, non-point or diffuse sources are pollutants whose sources are often not known. This could include run-off from agricultural fields or roads for example.<sup>79</sup> Pollutants from "agriculture, including nitrogen fertilisers applied to agricultural fields and manure from livestock farming, as well as erosion of soil containing nutrients, are responsible for 50 to 80 percent of all water pollution".<sup>80</sup> A briefing from the European Parliament Research Service lists some of the major sources of water pollution, which are summarised below:

- **Organic Waste**  
Organic waste is decomposed in water by bacteria which requires oxygen. If excessive organic material is decomposed in water the oxygen content is depleted and this can have an impact on aquatic lifeforms that need oxygen to survive (such as fish). Some of the common sources of organic waste include municipal wastewater and manure from agriculture for example.<sup>81</sup>
- **Nutrients and Eutrophication**  
Nitrates and phosphorous are plant nutrients that can promote excessive weed and algae growth in water and are used in agriculture. Nitrates can cause nutrient overload in the process known as eutrophication. This can cause an algal bloom that can cover the surface of the water. This reduces the amount of sunlight available for aquatic plants and can disrupt a river ecosystem.<sup>82</sup>

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<sup>74</sup> European Parliamentary Research Service, [Freshwater Protection: EU Policy and the Status of Freshwater Systems](#), February 2017, p 5.

<sup>75</sup> *ibid.*

<sup>76</sup> *ibid.*, p 6.

<sup>77</sup> *ibid.*

<sup>78</sup> *ibid.*, p 7.

<sup>79</sup> *ibid.*

<sup>80</sup> *ibid.*, pp 7–8.

<sup>81</sup> *ibid.*, p 9.

<sup>82</sup> *ibid.*, pp 9–10.

- **Persistent, Bioaccumulative and Toxic Substances**

Some substances that find themselves into rivers are toxic. Persistent, bioaccumulative and toxic substances (PBTs) can be a serious threat to aquatic and human health and take a long time to break down. If an animal ingests or is exposed to a PBT, the concentration can increase over time in a process known as bioaccumulation. This can move up the food chain if the animal is eaten in a process known as biomagnification.<sup>83</sup>

PBTs comprise persistent organic pollutants (PoPs) such as pesticides and industrial chemicals and heavy metals, such as mercury or lead.<sup>84</sup>

- **Physical Pollutants**

These can include suspended solids, such as clay or sand. These cannot dissolve in water or settle. These can reduce the sunlight available for aquatic plants and disrupt food chains. Likewise, the lack of available sunlight can make it difficult for predators to catch prey.

In addition, so-called microplastics are also a potential problem. These are caused by body care products, cleaning agents and pharmaceuticals for example entering the water. However, there is only a few studies on the effects of microplastics.<sup>85</sup>

## 2.2 Marine Pollution

Marine pollution is also a significant problem. According to UNESCO, approximately 80 percent of marine pollution is from land-based sources. This can include “agricultural run-off, discharge of nutrients and pesticides and untreated sewage including plastics”.<sup>86</sup> UNESCO has reported that there are now 500 so-called dead zones worldwide, covering 245,000 square kilometres of ocean. These are low-oxygen regions caused by excessive nutrients from sewage outfalls and agricultural run-off and marine life cannot survive in these regions.<sup>87</sup> Plastics are another source of ocean pollution. In 2006, it was estimated that every square mile of ocean contains 46,000 pieces of floating plastic.<sup>88</sup> In February 2017, scientists announced that they had found evidence of high concentrations of PoPs in the 10 kilometre Mariana trench—one of the deepest and remote parts of the Pacific Ocean. The lead researcher, Alan Jamieson of Newcastle University, observed that

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<sup>83</sup> European Parliamentary Research Service, [Freshwater Protection: EU Policy and the Status of Freshwater Systems](#), February 2017, pp 10–11.

<sup>84</sup> *ibid.*

<sup>85</sup> *ibid.*, p 13.

<sup>86</sup> UNESCO, [‘Facts and Figures in Marine Pollution’](#), accessed 18 October 2017.

<sup>87</sup> *ibid.*

<sup>88</sup> *ibid.*

“the fact that we found such extraordinary levels of these pollutants really brings home the long-term, devastating impact that mankind is having on the planet”.<sup>89</sup>

The International Programme on the State of the Ocean (IPSO) argued in 2013 that “the magnitude of the cumulative impacts on the ocean is greater than previously understood”.<sup>90</sup> It observed that the interactions between different impacts can be synergistic and cause greater impacts. Some of these examples included:

- Combinations of overfishing, physical disturbance, climate explosions of these invasive species—including harmful algal blooms—and dead zones;
- increased temperature and acidification increasing the susceptibility of corals to bleaching and to acting synergistically to impact the reproduction and development of other marine invertebrates;
- changes in the behaviour, fate and toxicity of heavy metals with acidification—acidification may reduce the limiting effect of iron availability on primary production in some parts of the ocean; increased uptake of plastics by fauna, and increased bioavailability of pollutants through adsorption onto the surface of microplastic particles; and
- feedbacks of climate change impacts on the oceans (temperature rise, sea level rise, loss of ice cover, acidification, increased storm intensity, methane release) on their rate of carbon dioxide uptake and global warming.<sup>91</sup>

### 2.3 Water Quality Legislation

The EU’s Water Framework Directive (2000/60/EC) seeks to protect the rivers, lakes, estuaries, coastal waters and groundwater in the EU.<sup>92</sup> The European Environment Agency has published a summary setting out the key features of the Directive:

The Water Framework Directive (WFD), which came into force in 2000, establishes a new framework for the assessment, management, protection and improvement of the quality of water resources across the EU.

<sup>89</sup> Damian Carrington, ‘[“Extraordinary” Levels of Pollutants Found in 10km Deep Mariana Trench](#)’, *Guardian*, 13 February 2017.

<sup>90</sup> International Programme on the State of the Ocean, ‘[The State of the Ocean Report 2013](#)’, September 2013

<sup>91</sup> *ibid*

<sup>92</sup> Joint Nature Conservation Committee, ‘[Council Directive 2000/60/EC Establishing a Framework for Community Action in the Field of Water Policy \(Water Framework Directive\)](#)’, accessed 20 October 2017.

EU member states should aim to achieve good status in all bodies of surface water and groundwater by 2015 unless there are grounds for exemption. Only in this case may achievement of good status be extended to 2021 or 2027 at the latest. Achieving good status involves meeting certain standards for the ecology, chemistry, morphology, and quantity of waters. In general terms, good status means that water shows only a slight change from what would normally be expected under undisturbed conditions (ie with a low human impact).<sup>93</sup>

Under the Directive, good ecological status is also related to water quantity. The over-abstraction of water can harm freshwater ecosystems by reducing water levels in rivers and groundwater sources, and drying up wetlands.<sup>94</sup> The goal of achieving a ‘good’ status for all EU water bodies by 2015 was not met.<sup>95</sup>

The Directive requires that member states implement River Basin Management Plans (RBMPs). These were first introduced in 2010 and are reviewed every six years.<sup>96</sup> The UK is divided into 16 river basin districts (RBDs); eleven in England and Wales, three in Scotland and four in Northern Ireland (including three international RBDs).<sup>97</sup>

Water quality is devolved in the UK. Regulation is provided for by Natural Resources Wales and by the Environment Agency in England. The Water Framework Directive is implemented by the Water Environment (Water Framework Directive (England and Wales) Regulations 2003. In Scotland, the Directive is implemented through the Water Environment and Water Services (Scotland) Act 2003, and water quality is regulated by the Scottish Environment Protection Agency. In Northern Ireland it is regulated by the Department of Environment Northern Ireland and implemented through the Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2003.

The Bathing Water Directive (2006/7/EC) protects “bathing water areas” in the UK. The Water Framework Directive classifies bathing water areas as ‘protected areas’, which means they require special protections. The Bathing Water Directive requires member states “to monitor and assess the bathing water for at least two parameters of (faecal) bacteria”.<sup>98</sup> In addition, it requires that member states publish bathing water profiles, which contain information on the sorts of pollution and sources that affect bathing water

<sup>93</sup> European Environment Agency, ‘[Freshwater Quality](#)’, 18 February 2015.

<sup>94</sup> *ibid.*

<sup>95</sup> European Parliamentary Research Service, [Environmental Implementation Review: Initial Findings](#), March 2017, p 3.

<sup>96</sup> Joint Nature Conservation Committee, ‘[Council Directive 2000/60/EC Establishing a Framework for Community Action in the Field of Water Policy \(Water Framework Directive\)](#)’, accessed 20 October 2017.

<sup>97</sup> European Commission, ‘[United Kingdom River Basin Management Plans](#)’, 20 October 2017.

<sup>98</sup> European Commission, ‘[Bathing Water Quality](#)’, 23 May 2017.

quality and could potentially affect a bather's health.<sup>99</sup>

The EU's Drinking Water Directive (98/83/EC) seeks to "protect human health from adverse effects of any contamination of water intended for human consumption by ensuring that it is wholesome and clean".<sup>100</sup> The Directive requires that member states must regularly monitor and test a "total of 48 microbiological, chemical and indicator parameters".<sup>101</sup> The World Health Organisation's guidelines for drinking water and the European Commission's Scientific Advisory Committee provide the scientific basis for the quality standards.<sup>102</sup> The Directive also requires that member states report drinking water quality to the European Commission every three years and provide information to the public.

The Marine Strategy Framework Directive (2008/56/EC) was introduced in June 2008. The European Commission has published an overview of the Directive:

The Marine Directive aims to achieve Good Environmental Status (GES) of the EU's marine waters by 2020 and to protect the resource base upon which marine-related economic and social activities depend. It is the first EU legislative instrument related to the protection of marine biodiversity, as it contains the explicit regulatory objective that "biodiversity is maintained by 2020", as the cornerstone for achieving GES.

The Directive enshrines in a legislative framework the ecosystem approach to the management of human activities having an impact on the marine environment, integrating the concepts of environmental protection and sustainable use.<sup>103</sup>

The Directive establishes a number of regions and sub-regions and member states are required to develop a strategy for its marine waters.<sup>104</sup> The Directive also specifies that member states should establish Marine Protected Areas.<sup>105</sup>

## 2.4 Statistics on Water Pollution

The Joint Nature Conservation Committee (JNCC)—a public body that advises the Government on nature conservation—reported that the number of water bodies awarded high or good surface water status between 2011

<sup>99</sup> European Commission, '[Bathing Water Quality](#)', 23 May 2017.

<sup>100</sup> European Commission, '[Drinking Water Directive](#)', 8 June 2016.

<sup>101</sup> *ibid.*

<sup>102</sup> *ibid.*

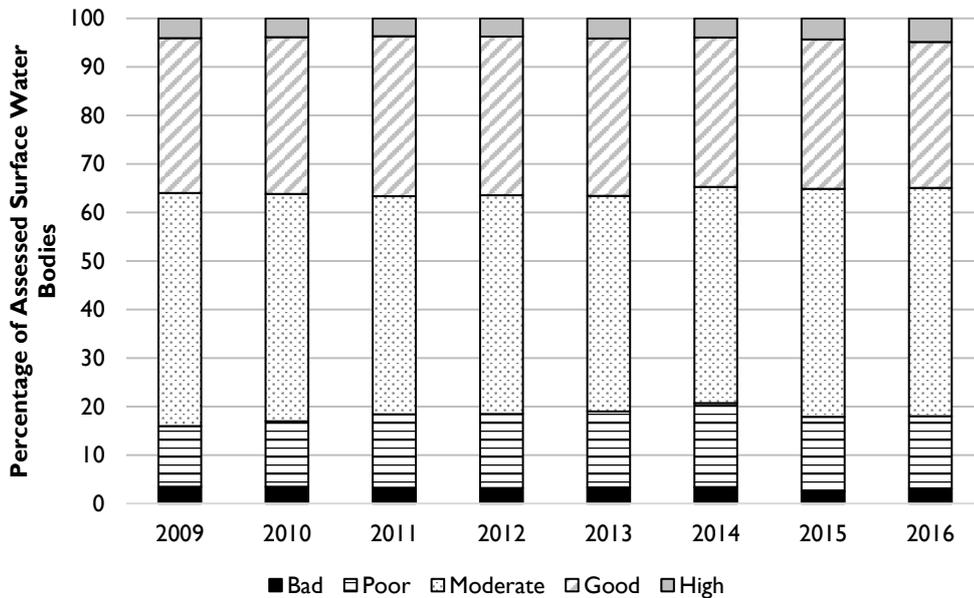
<sup>103</sup> European Commission, '[Legislation: the Marine Directive](#)', 18 May 2017.

<sup>104</sup> *ibid.*

<sup>105</sup> Joint Nature Conservation Committee, '[EU Marine Strategy Framework Directive](#)', August 2017.

and 2016 decreased from 37 percent in 2011 to 35 percent in 2016.<sup>106</sup> The following chart shows the classification of UK water bodies under the Water Framework Directive since 2009.

**Chart 1: Status classification of UK surface water bodies under the Water Framework Directive, 2009–2016**



(Source: Joint Nature Conservation Committee, '[B7. Surface Water Status](#)', August 2017)

With regard to English coastal and inland bathing waters, the Department for Environment, Food and Rural Affairs has published statistics. The headline results were as follows:

- In 2016, out of the 413 bathing waters measured in England, 407 (98.5 percent) met at least the minimum standard of the Bathing Water Directive.
- In 2016, 287 bathing waters in England (69.5 percent) met the excellent standard of the Bathing Water Directive.
- In 2016, 6 bathing waters in England (1.5 percent) did not meet the minimum standard, and were classified as poor.<sup>107</sup>

<sup>106</sup> Joint Nature Conservation Committee, '[B7. Surface Water Status](#)', August 2017.

<sup>107</sup> Department for Environment, Food and Rural Affairs, '[Statistics on English Coastal and Inland Bathing Waters: A Summary of Compliance with the 2006 Bathing Water Directive](#)', 8 November 2016, p 1.

The UK Drinking Water Inspectorate reported that, in 2016, public water supply compliance with EU legislation was 99.96 percent.<sup>108</sup>

## 2.5 Government Policy

The latest River Basin Management Plans (RBMPs) for England were published on 18 February 2016 by the Environment Agency and cover the years 2016 to 2021. These set out how organisations, stakeholders and communities will work together to improve the water environment.<sup>109</sup> The Department for Environment, Food and Rural Affairs and the Environment Agency have set out what these plans cover:

A RBD covers an entire river system, including river, lake, groundwater, estuarine and coastal water bodies. The RBD RBMPs are designed to protect and improve the quality of our water environment. Good quality water is essential for wildlife, agriculture and business to thrive. And is one of the means for boosting regeneration (both structural and economic), recreation and tourism.<sup>110</sup>

In response to a written question, the Government has set out what these plans will deliver by 2021:

Updated River Basin Management Plans published in 2016 provide the framework for protecting and improving the water environment, and focus on the improvements for the period 2016 to 2021. The Plans for England confirm over £3 billion of investment by 2021, leading to improvements in at least 680 water bodies. This includes an overall target to enhance at least 5,000 miles of waters by 2021.

The Plans will be reviewed and updated in 2021 taking account of progress that has been made and the best evidence then on what can be achieved by 2027.<sup>111</sup>

Natural Resources Wales, the Scottish Environment Protection Agency, and the Northern Ireland Department of the Environment's latest RBMPs covering 2016 to 2021 were adopted in December 2015.<sup>112</sup>

Part three of the UK Government's marine strategy sets out the measures that DEFRA and the devolved administrations will implement to reduce marine pollution.

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<sup>108</sup> Drinking Water Inspectorate, [Drinking Water 2016](#), July 2017, p 7.

<sup>109</sup> Department for Environment, Food and Rural Affairs and Environment Agency, '[River Basin Management Plans](#)', 18 February 2016.

<sup>110</sup> *ibid.*

<sup>111</sup> House of Commons, '[Written Question: Water EU Law](#)', 19 July 2017, 6280.

<sup>112</sup> European Commission, '[United Kingdom 2nd RBMPs \(2016–2012\)](#)', accessed 20 October 2017.

In a recent answer to a written question, the Government have summarised these measures:

Defra and the Devolved Administrations have provided information to the public about chemicals dispersed to the UK seas through their public consultations on the assessment of the state of the UK seas set out in *UK Marine Strategy Part 1*. This assessment will be updated in 2018.

Under the *Marine Strategy Part 3*, Defra and the Devolved Administrations have set out a programme of measures which reduce contaminant concentrations in the marine environment to acceptable levels. These include various pollution reduction requirements for emissions and discharges from industry, and measures for coastal waters that are set out in the Water Framework Directive River Basin Management Plans, published by the UK environment agencies.

The UK also contributes to, and implements, the obligations of several UN initiatives, which protect the world's oceans from mercury, persistent organic pollutants, hazardous wastes, hazardous chemicals and pesticides.

The UK, as a signatory to the Oslo and Paris Convention (OSPAR), submits annual returns of the quantities of contaminants which enter UK seas. This information is made available via the OSPAR website.

The UK Government is committed to the effective delivery of UN Sustainable Development Goal 14, including target 14.1.<sup>113</sup>

In June 2017, the UK Government attended the United Nations Ocean Conference in New York which sought to encourage international action on implementing sustainable development goal (SDG) 14—conserve and sustainably use the oceans, seas and marine resources for sustainable development. In a written statement the Parliamentary Under Secretary of State for the Environment, Thérèse Coffey, said the conference produced “two major outcomes: a call for action and a registry of over 1,300 voluntary commitments made by the global community to support the implementation of SDG 14”.<sup>114</sup> She added that the UK had signed up to the UN Environment Clean Seas Campaign and made four voluntary commitments, “highlighting our work on Marine Protected Areas, including in the Overseas Territories; marine science; marine litter and the Commonwealth Marine Economies Programme”.<sup>115</sup>

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<sup>113</sup> House of Lords, [‘Written Question: Chemicals: Seas and Oceans’](#), 27 March 2017, HL6319.

<sup>114</sup> House of Commons, [‘Written Statement: The United Nations Ocean Conference’](#), 13 July 2017, HCWS44.

<sup>115</sup> *ibid.*

In September 2016, the Government announced plans to ban the sale and manufacture of cosmetics and personal care products containing tiny pieces of plastic, known as ‘microbeads’.<sup>116</sup> These can enter the ocean and potentially enter the food chain.<sup>117</sup> Following a consultation, in July 2017, the Environment Secretary, Michael Gove, stated that the Government would introduce legislation later in 2017 to ban the sale and manufacture of microbeads. Separate laws to implement this will be introduced in the devolved administrations.<sup>118</sup> The Government also reported that the 5p plastic bag charge had resulted in a reduction of nine billion fewer bags—an 83 percent fall.<sup>119</sup>

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<sup>116</sup> Department for Environment, Food and Rural Affairs, ‘[Microbead Ban Announced to Protect Sealife](#)’, 3 September 2016.

<sup>117</sup> BBC News, ‘[Plastic Microbeads to be Banned by 2017 UK Government Pledges](#)’, 3 September 2016.

<sup>118</sup> Department for Environment, Food and Rural Affairs, ‘[Banning the Use of Microbeads in Cosmetics and Personal Care Products](#)’, 20 December 2016.

<sup>119</sup> Department for Environment, Food and Rural Affairs, ‘[Environment Secretary Pledges Action on Ocean Plastics](#)’, 21 July 2017.