



House of Commons  
Environmental Audit Committee

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**UK Progress on  
reducing F-gas  
Emissions**

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**Fifth Report of Session 2017–19**

*Report, together with formal minutes relating  
to the report*

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## Environmental Audit Committee

The Environmental Audit Committee is appointed by the House of Commons to consider to what extent the policies and programmes of government departments and non-departmental public bodies contribute to environmental protection and sustainable development; to audit their performance against such targets as may be set for them by Her Majesty's Ministers; and to report thereon to the House.

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## Summary

Originally introduced to replace ozone depleting substances, fluorinated gases (F-gases) are greenhouse gases (GHGs) with a high global warming potential (GWP) that can remain in the atmosphere for many years. Though a small part of the UK's GHGs, reducing them can contribute to UK and global efforts to address climate change. The international community have agreed to reduce their use and in 2015 the EU introduced a phased market-based quota system to reduce their availability and drive take-up of alternatives. So far, this has delivered modest progress ahead of agreed deeper cuts. In the UK, this can help meet legally binding Carbon Budgets. Globally, if all countries meet agreed targets on reducing F-gases, it would reduce global temperature rises across this century by half a degree, significantly reducing the impact of global warming. Curbing their use is achievable because many of the most widely used F-gases—hydrofluorocarbons (HFCs), used primarily as refrigerants and propellants, can be replaced by lower GWP alternatives.

However, the Government must enforce existing F-gas rules to phase down the use of HFCs and meet the UK's legally binding carbon budgets. The Government must ensure that adequate resources are allocated to monitoring illegal activities, especially online, and that only qualified persons handle F-gases. For instance, the legal availability of high GWP HFCs for the unsupervised top-up of car air conditioning units risks undermining the system, and illegal activities put responsible businesses at a disadvantage and endanger consumers if refrigerants are used inappropriately, such as flammable HFCs being applied to systems designed for low flammable HFCs. After only one successful prosecution since 2015, for a self-reported offence of releasing high GWP sulphur hexafluoride (SF<sub>6</sub>) into the atmosphere, the Government recently introduced civil penalties to make it easier to prosecute offenders but this will only work if the system is properly resourced.

There are opportunities to go further and faster. For example, the NHS should reduce reliance on asthma medication which uses Metered Dose Inhalers (MDIs), which use high GWP HFC propellants, by increasing the use of low GWP Dry Powdered Inhalers. In addition, medical companies or the NHS should establish a pharmacy recycling system to ensure that residual HFCs from MDIs are recycled rather than being released in landfill. The Government should also ensure that heat pumps, a renewable energy source, use low GWP refrigerants and that its sizeable procurement power is used to promote low GWP alternatives more widely.

The UK's withdrawal from the EU raises significant challenges for the UK's F-gas regime. The negotiations will determine whether the UK remains in the EU's quota system or sets up its own regime. If the UK does leave the EU system, it is highly likely UK businesses will be faced with additional costs if they continue to trade in Europe. This is because they will have to join a UK system while being subject to the rules of the EU Quota. Furthermore, as they will not be members of the EU Quota they will lose flexibility in trading quotas with European counterparts. Outside of the EU system, the UK will lose the monitoring, oversight and enforcement provided by EU institutions

and will need to replicate them, including a new UK F-gas registry. UK agencies, which already appear stressed, will need adequate resourcing to do this. The Government must ensure that new trade deals do not lower standards on products using high GWP HFCs.

If the UK leaves the EU's F-gas system, and devolved powers are repatriated to the UK, there could be policy divergence across the UK, which could lead to additional red tape and costs for business. This is because with the planned repeal of the European Communities Act 1972 and without any provision made expressly by primary UK legislation, the devolved legislatures will be free to legislate in those areas of devolved competence, such as the environment, where the EU has jurisdiction and where EU law has primacy. The Government needs to outline a timetable for its negotiations with the devolved Administrations on how F-gases will be managed after we leave the EU. There are particular issues for Northern Ireland because of the desire to avoid a hard border with the Republic of Ireland. The Government must find a solution for Northern Ireland which does not create a back door for appliances containing F-gases banned in either the UK or the EU if one jurisdiction has higher—or lower—standards.

The UK's withdrawal from the EU has led to uncertainty over the status of mixed multilateral international agreements, where both the UK and EU signed. This is because it is not always clear which competences the UK and the EU signed up to, which could cast doubt on the UK's continuing membership of such agreements. This applies to F-gases, because international action is governed through such an agreement—the Kigali Amendment to the Montreal Protocol, but also to more complex agreements, such as the Kyoto Protocol to the UN Framework Convention on Climate Change. Though it is unlikely that the UK would drop out of such agreements, the Government should address uncertainty by publishing legal analysis on their status and seek to issue a joint statement with the EU to confirm that the UK will fully assume its obligations when it leaves the EU.

# 1 Introduction

## What are F-gases and why do they matter?

1. Fluorinated gases (F-gases) are a family of artificial gases used in various industrial applications. The most common types are Hydro-fluorocarbons (HFCs), which account for 95% of F-gas emissions and are mainly used as refrigerants or in foams, aerosols and fire extinguishers.<sup>1</sup> Sulphur-hexafluoride (SF<sub>6</sub>), which represent 3% of F-gas emissions, is used mainly as an insulating gas for high voltage switch gear and in magnesium casting and military applications. Perfluorocarbons (PFCs), which account for 2% of F-gas emissions are typically used in the electronics sector (e.g. cleaning silicon wafers).<sup>2</sup>

2. HFCs were developed in the 1990s as substitutes for ozone-depleting substances such as chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs).<sup>3</sup> While HFCs do not deplete the ozone layer, they are powerful greenhouse gases (GHGs).<sup>4</sup> The potency of gases in impacting upon climate change is measured by their Global Warming Potential (GWP). It compares the amount of heat trapped by a certain mass of the gas to the amount of heat trapped by a similar mass of CO<sub>2</sub>, where CO<sub>2</sub> has a value of one.<sup>5</sup> A gas which traps twice as much heat as CO<sub>2</sub> would have a GWP of 2, for example. HFCs and F-gases more generally, often have a GWP several thousand times more powerful than CO<sub>2</sub> and can persist in the atmosphere for many years after they have been released. See Box 1 below.<sup>6</sup> For more detail regarding F-gases see the Appendix.

**Box 1: GWP and Longevity of Different F-gases**

Type of F-gas	Global Warming Potential (GWP)	Lifetime in Atmosphere
HFCs	Up to 14,800	Up to 270 years
PFCs	7,390 to 12,200	2,600 to 50,000 years
SF <sub>6</sub>	22,800	3,200 years
NF <sub>3</sub>	17,200	740 years

3. Policy has focused on introducing lower GWP alternatives. However, there are some concerns with some of the lower GWP F-gas alternatives. Some, such as carbon dioxide (GWP 1), have to be used and stored at higher pressure. This requires more energy, with the possibility that reductions in direct emissions can be offset or exceeded by indirect

1 Committee on Climate Change, [Meeting Carbon Budgets: Closing the policy gap](#), p 166. See also: European Commission, [Climate Action: Action on Fluorinated Greenhouse Gases](#), (accessed 8 February 2018).

2 As above. A fourth type of F-gas—nitrogen trifluoride (NF<sub>3</sub>) accounts for very low emissions and results from semi-conductor manufacturing.

3 International action to reduce the use of ozone depleting substances was agreed by the Vienna Convention for the Protection of the Ozone layer and the subsequent Montreal Protocol. Specific action designed to target HFCs—the Kigali Amendment, was part of this process. See UNEP Ozone Secretariat, [The Vienna Convention for the Protection of the Ozone Layer](#), (accessed 8 February 2018) and US Environmental Protection Agency, [Ozone Layer Protection: International Treaties and Cooperation](#), (accessed 8 February 2018). For an overview of success in curbing ozone depletion see: World Meteorological Organization et al, [Assessment for Decision-Makers: Scientific Assessment of Ozone Depletion](#), (2014). An update is due for publication in 2018.

4 See United Nations Environmental Programme, Montreal Protocol, (accessed 8 February 2018) and Climate Home News, [Ozone layer treaty could tackle super polluting HFCs](#), (15 July 2017).

5 For a fuller explanation of GWP see: United States Environmental Protection Agency, Greenhouse Gas Emissions: Understanding Global Warming Potentials, (accessed 20 February 2017).

6 United States Environmental Protection Agency, [Overview of Greenhouse Gases](#), (accessed 26 February 2018)..

energy emissions.<sup>7</sup> Others, such as propane and butane are highly flammable, while Hydrofluoroolefins (HFOs) are mildly flammable, which either rule out their use or require technicians to oversee their use and storage.<sup>8</sup> Alternatives, such as ammonia, are toxic and require special care. In some cases, the cost of producing or acquiring the alternative substance can be a barrier along with those of installation, retrofitting, maintenance and (re)training.<sup>9</sup>

## F-gases and Climate Change

4. F-gases are currently released in small amounts, mainly through leakages from appliances, but reducing them can make an important contribution to reducing global warming. The United Nations Environment Programme states that international efforts to reduce HFCs (i.e. the Kigali Amendment to the Montreal Protocol), are expected to avoid up to 0.5° Celsius warming by the end of the century.<sup>10</sup> The Kigali amendment is also significant because it is achievable and supported by stakeholders including industry. The 2015 Paris Agreement on climate change contains a commitment to limit global temperature rises to no more than 2°C, and pursue efforts to limit the temperature increase ambitions to no more than 1.5°C above pre-industrial levels. This means reductions in F-gases are equal to the difference between the Paris Agreement’s agreed target of reducing global temperature rises across this century by 2°Celsius and the more ambitious target of 1.5°, which nations are endeavouring to meet, and which would significantly reduce the risks and impacts of climate change.<sup>11</sup> The difference between 1.5°C and 2.0°C is thought to mean the difference between 10cm of global sea level rises by 2100, and is “likely to be decisive for the future of coral reefs”.<sup>12</sup>

5. The Committee on Climate Change (CCC) estimate that F-gases accounted for about 3% of overall UK GHG emissions in 2015.<sup>13</sup> However, there has been increasing demand for their use, especially in air conditioning and refrigeration, in part due to increases in global temperatures.<sup>14</sup> They are tracked in the UK by the CCC as part of UK efforts to reduce GHG emissions and deliver on UK commitments made under the Kyoto Protocol and Paris Agreement.<sup>15</sup>

7 European Commission Climate Change Action, [Climate-friendly Alternatives to HFCs and HCFCs](#), (accessed 15 February 2018).

8 RFG0006 (Airedale International Air Conditioning Ltd); RFG0003 (Federation of Environmental Trade Associations).

9 RFG0006 (Airedale International Air Conditioning Ltd); RFG0008 (REFCOM).

10 UNFCC, [Nations Agree to Curb Powerful Greenhouse Gases HFCs in Largest Climate Breakthrough since Paris](#), (October 2016). See also: International Centre for Trade and Sustainable Development, <https://www.ictsd.org/bridges-news/bridges/news/montreal-protocol-amendment-to-phase-down-hfcs-set-for-2019-start>, (November 2017).

11 See UNFCCC, [The Paris Agreement](#), (accessed 8 February 2018).

12 Carl-Friedrich Schleussner et al. 'Differential climate impacts for policy-relevant limits to global warming: the case of 1.5°C and 2°C. *Earth Syst. Dynam.*, 7, 327–351, 2016.

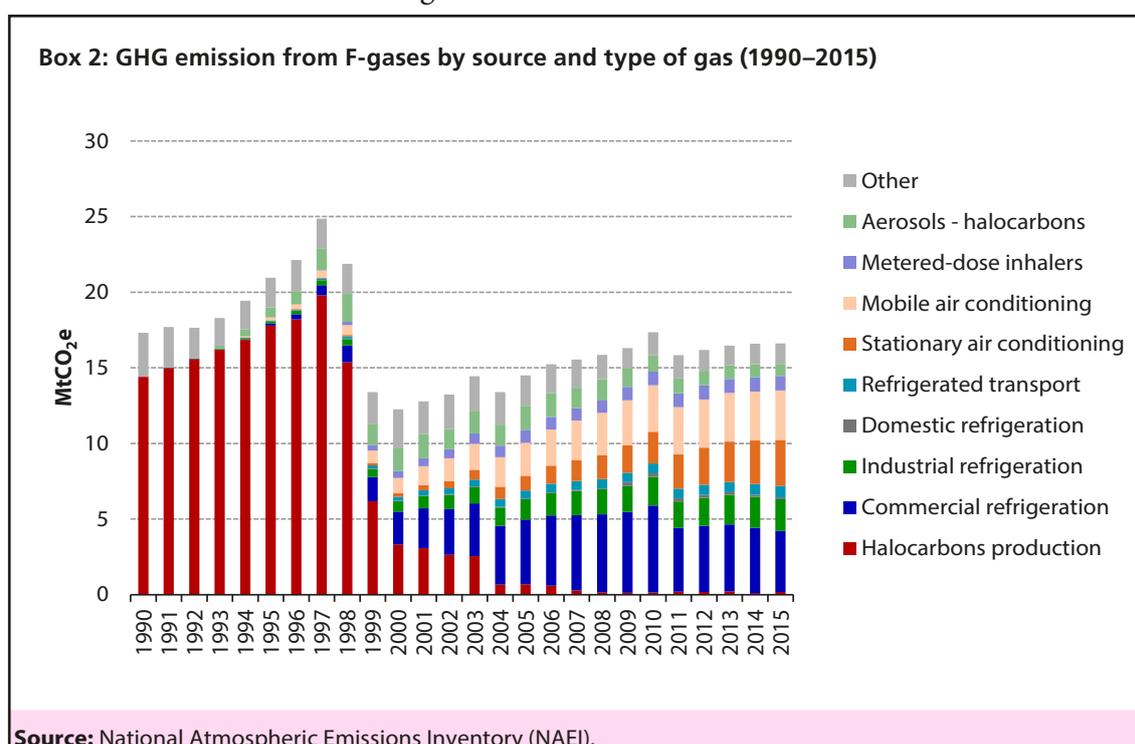
13 Committee on Climate Change, [Meeting Carbon Budgets: Closing the policy gap](#), p 167.

14 See for example: Jeff Tollefson, ['Nations agree to ban refrigerants that worsen climate change'](#), *Nature*, (October 2016); US Department of Energy, [The Future of Air Conditioning for Buildings](#), (July 2016); *The Economist*, [To Coldly Go](#), (September 2016); UNCCC, [Phasing Down HFCs, the Climate's Low-Hanging Fruit](#), (October 2016).

15 The Kyoto Protocol lists six GHGs: Carbon dioxide (CO<sub>2</sub>); Methane (CH<sub>4</sub>); Nitrous oxide (N<sub>2</sub>O); Hydrofluorocarbons (HFCs); Perfluorocarbons (PFCs); and Sulphur hexafluoride (SF<sub>6</sub>). See: [http://unfccc.int/kyoto\\_protocol/items/3145.php](http://unfccc.int/kyoto_protocol/items/3145.php). For the Committee on Climate Change’s role and the UK’s legislative basis for reducing GHGs, including F-gases, see: <https://www.theccc.org.uk/tackling-climate-change/the-legal-landscape/the-climate-change-act/>.

## What action is being taken to address F-gases?

6. When it was realised by scientists that F-gases were powerful GHGs,<sup>16</sup> steps were taken to reduce them by industry,<sup>17</sup> governments and international organisations. This took the form of using industrial abatement technologies during the 1990s to reduce emissions from one type of F-gas—halocarbons.<sup>18</sup> However, after cuts to emissions of halocarbons in the late 1990s, F-gas emissions began to increase again, mainly due to increased demand for HFC refrigerants. This is set out in Box 2 below.<sup>19</sup>



## EU action on F-gases

7. After action on reducing halocarbons, efforts then focused on reducing other F-gases, especially HFCs. The EU has done this through two main routes. First, through two regulations: the 2006 F-Gas Regulation ((EU) 842/2006) and the 2014 F-Gas Regulation ((EU) 517/2014) and, secondly, the 2006 Mobile Air Conditioning (MAC) Directive. The

16 For an overview of the scientific basis for the climate warming potential of HFCs and PFCs see: Intergovernmental Panel on Climate Change (IPCC), [Safeguarding the Ozone Layer and the Global Climate System: Issues Related to Hydrofluorocarbons and Perfluorocarbons](#), (2005).

17 This included initiatives such as Refrigerants, Naturally!, set up in 2004 by Coca Cola, Unilever and McDonalds which agreed to replacing synthetic refrigerants with natural refrigerants using HFC-free insulation material whilst also reducing the energy consumption of new refrigeration equipment. Since then other companies, such as Red Bull and Pepsi, have joined with support from Green Peace and the UNEP. It estimates that it has installed 5.5 million units using natural refrigerants, the equivalent of 33 million tonnes of avoided CO<sub>2</sub>. See: <http://www.refrigerantsnaturally.com/>.

18 For an overview of halocarbons and how they were gradually replaced and reduced across the 1990s see: European Commission, [Preparatory study for a review of Regulation \(EC\) No 842/2006 on certain fluorinated greenhouse gases: Final Report](#), (September 2011), pp 35–38. See also: UK National Atmospheric Emissions Inventory, [About HFCs](#), (accessed 8 February 2018).

19 Committee on Climate Change, [Meeting Carbon Budgets: Closing the policy gap](#), p 167 and . Atmospheric Emissions Inventory (NAEI), [About HFCs](#), (accessed 17 February 2017).

MAC Directive introduced a phasing out of high GWP refrigerants (e.g. R134a) in cars and light vans and stipulates that the recovery of F-gases from such vehicles must be carried out by trained and certified persons.<sup>20</sup>

8. The 2006 F-gas Regulation introduced several measures, such as:

- labelling of equipment containing F-gases;
- training and certification for those handling F-gases; improvements in leakage reduction;
- recovery of unused F-gases from appliances;
- various restrictions on the use and marketing of F-gases where better alternatives were available.<sup>21</sup>

9. The first F-gas Regulation and related regulations were implemented in the UK by the Fluorinated Greenhouse Gases Regulations 2008.<sup>22</sup>

10. The 2014 F-gas Regulation, which came into effect in January 2015, aims to cut EU F-gas emissions by two-thirds by 2030. It sought to do this with a market-based approach with progressive cuts to HFCs through a quota system run by the European Environment Agency. Compliance is enforced by Member States.<sup>23</sup> In England, this is the responsibility of the Environment Agency, in Scotland the Scottish Environment Protection Agency,<sup>24</sup> in Wales Natural Resources Wales,<sup>25</sup> and in Northern Ireland, the Northern Ireland Environment Agency.<sup>26</sup> The intention was to drive up the costs of high GWP HFCs, especially refrigerants, encouraging conversion to cheaper low GWP alternatives and innovation where alternatives are not currently available. The 2014 F-gas Regulation includes several exemptions: metered dose asthma inhalers; military equipment; appliances that require an evaporation point below 50C. The 2014 F-gas Regulation will be reviewed

20 For a copy of the MAC Directive see: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32006L0040&from=EN>. For a brief summary of the 2006 MAC Directive see: European Commission, [The mobile air-conditioning systems MACs](#), (accessed 8 February 2017). For a more detailed overview see: Gluckman Consulting, [EU F-Gas Regulation Guidance - Information Sheet 6: Mobile Air-Conditioning](#), (accessed 8 February 2018).

21 For a copy of the first 2006 F-gas regulation see: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32006R0842&from=EN>. For a brief overview of the 2006 F-gas Regulation see: Federation of European Heating, Ventilation and Air Conditioning Associations, [F-Gas Regulation](#), (accessed 8 February 2018).

22 For a copy of the Regulations and accompanying Explanatory Memorandum see: <https://www.legislation.gov.uk/uksi/2008/41/contents/made>. They were updated in 2009 by the Fluorinated Greenhouse Gases Regulations 2009, which added further detail as to how the Regulations would be enforced. See: <https://www.legislation.gov.uk/uksi/2009/261/contents/made>.

23 For a copy of the 2014 F-gas Regulation see: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R0517&from=EN>. For an overview of how the 2014 F-gas Regulation applies to different sectors see: Gluckman Consulting, [EU F-Gas Regulation](#), (accessed 8 February 2018); Environmental Investigation Agency, [EU F-Gas Regulation Handbook: Keeping ahead of the curve as Europe phases down HFCs](#), (October 2015); European Association of Refrigeration, Air Conditioning and Heat Pump Contractors, [A Practical Guide on the Application of the New F-Gas Regulation to Refrigeration](#), Air Conditioning & Heat Pump Contractors, (October 2014).

24 For information on the Scottish Environment Protection Agency see: <https://www.sepa.org.uk/regulations/climate-change/fgases-and-ods/>.

25 See: Welsh Government, [Fluorinated Greenhouse Gases and Ozone-Depleting Substances](#), (accessed 17 February 2018).

26 See Northern Ireland Department of Agriculture, Environment and Rural Affairs, [Fluorinated Greenhouse Gases and Ozone Depleting Substances](#), (accessed 17 February 2018).

by the European Commission in 2022. The 2014 F-gas Regulation was implemented in the UK by the Fluorinated Greenhouse Gases Regulations 2015, which came into force in March 2015.<sup>27</sup>

### *International action on F-gases*

11. In 1987, UN countries agreed the adoption of the Montreal Protocol which seeks to limit the abundance of ozone depleting substances in the atmosphere.<sup>28</sup> The Protocol came into force on 1st January 1989. It has been amended several times as new scientific evidence and information has supported the acceleration of further steps to reduce such substances in the atmosphere.<sup>29</sup> In December 2016, UN countries agreed the adoption of the Kigali Amendment to the Montreal Protocol.<sup>30</sup> This amendment, rather than focusing on ozone depleting substances, reflected scientific evidence that indicated that HFCs were powerful greenhouse gases.<sup>31</sup> It seeks to phase down the use of HFCs globally by 80 to 85 percent by 2047, with different pathways identified for developed and developing countries.<sup>32</sup> The main aspects of the Montreal Protocol and the Kigali Amendment are set out in Box 3 below.<sup>33</sup>

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27 For a copy of the 2015 Regulations and accompanying Explanatory Memorandum see: <http://www.legislation.gov.uk/ukxi/2015/310/contents/made>. More detailed guidance on how the Regulations are applied in the UK can be found at: <https://www.gov.uk/government/collections/eu-f-gas-regulation-guidance-for-users-producers-and-traders>.

28 For an overview of the Montreal Protocol see: The Conversation, [After 30 years of the Montreal Protocol, the ozone layer is gradually healing](#), (September 2017); David W Fahey, 'The Montreal Protocol Protection of Ozone and Climate', *Theoretical Inquiries in Law*, Vol 14 No 21, (2013); European Commission, [The Montreal Protocol](#), (2007).

29 For details of the various amendments to the Protocol and the decisions taken by the Meetings of the Parties, see: <http://ozone.unep.org/en/treaties-and-decisions/montreal-protocol-substances-deplete-ozone-layer>.

30 See: Katie Forster, [More than 150 countries reach 'monumental' deal to phase out powerful greenhouse gases](#), *The Independent*, (October 2016); John Vidal, [Kigali deal on HFCs is big step in fighting climate change](#), *The Observer*, (October 2016); Christopher Booker, [Huffing and puffing over HFCs won't cut global warming](#), *The Telegraph* (October 2016).

31 See: Stephen O. Andersen et al., [A Global Response to HFCs through Fair and Effective , Ozone and Climate Policies](#), Chatham House Research Paper, (2014).

32 For a copy of the text of the Kigali Amendment see: <https://treaties.un.org/doc/Publication/CN/2016/CN.872.2016-Eng.pdf>.

33 Environmental Investigation Agency, [Kigali amendment to the Montreal Protocol: A Crucial Step in the Fight Against Catastrophic Climate Change](#), (November 2016), p 2 and Defra, [UK leads the world in new agreement to tackle global warming](#), (September 2017). See also: UNEP, [The Kigali Amendment to the Montreal Protocol: HFC Phase-down](#), (accessed 8 February 2018) and John Vidal, ['Kigali deal on HFCs is big step in fighting climate change'](#), *Guardian*, (October 2016).

**Box 3: The Montreal Protocol and the Kigali Amendment**

The Montreal Protocol, the international treaty under which the Kigali Amendment sits, came into force in 1989 and is already one of the most successful treaties ever agreed, having successfully phased out 98% of ozone depleting substances – including chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons. As a result, the ozone layer is showing the first signs of recovery.

The Kigali amendment to the Montreal Protocol, which was agreed by UN countries in December 2016, extends targets to hydro-fluorocarbon greenhouse gases (HFCs). It commits nations to reducing HFCs by 85% between 2019 and 2036. To reach this target, developed countries agreed to an 85% phase-down between 2019 and 2036; most developing countries agreed to 80% between 2024 and 2045; and ten developing countries (India, Pakistan, Saudi Arabia, Bahrain, Kuwait, Oman, Qatar, The United Arab Emirates, Iran and Iraq) agreed to 85% between 2028 and 2047. The exact phasing of this is set out below:

	Non-A5 (developed countries)	A5 (developing countries) Group 1	A5 (developing countries) Group 2
Baseline HFC component	2011-2013 (average consumption)	2020-2022 (average consumption)	2024-2026 (average consumption)
Baseline HCFC component	15% of baseline	65% of baseline	65% of baseline
Freeze	-	2024	2028
1st step	2019 - 10%	2029 - 10%	2032 - 10%
2nd step	2024 - 40%	2035 - 30%	2037 - 20%
3rd step	2029 - 70%	2040 - 50%	2042 - 30%
4th step	2034 - 80%	-	-
Plateau	2036 - 85%	2045 - 80%	2047 - 85%
Notes	Belarus, Russian Federation, Kazakhstan, Tajikistan, Uzbekistan, 25% HCFC component and 1st two steps are later: 5% in 2020, 35% in 2025	Article 5 countries not part of Group 2	GCC (Saudi Arabia, Kuwait, United Arab Emirates, Qatar, Bahrain, Oman), India, Iran, Iraq, Pakistan

12. In July 2017, the European Council confirmed that it had adopted the Amendment on behalf of the EU and announced that it would come into effect on 1 January 2019.<sup>34</sup> In September 2017, the UK Government laid a Treaty (Cm 9496) in Parliament to enable UK ratification of the Amendment.<sup>35</sup>

13. The Montreal Protocol and Kigali Amendment includes agreements by rich countries to help finance the transition of poor countries to alternative safer products. The UK, for instance, contributes £9m a year through its Official Development Assistance budget to the Multilateral Fund for the Implementation of the Montreal Protocol, which helps developing

34 See European Council, [Protecting Climate: EU gives green light to ratify the Kigali Amendment to the Montreal Protocol](#), (17 July 2017). The Council noted that the EU had already adopted instruments (i.e. the F-gas Regulation and MAC Directive) on the matters covered by the Kigali Amendment. The European Parliament had given its [formal consent](#) on 5 July.

35 See: Defra, [UK leads the world in new agreement to tackle global warming](#), (September 2017) and [Treaty \(Cm 9496\)](#).

countries finance projects to help their businesses and consumers switch to alternatives to ozone depleting substances and HFCs.<sup>36</sup> In some respects, the Kigali Amendment adopts a similar phase-down approach to the EU's. However, the EU regulation is more ambitious up until 2034, is more prescriptive in terms of mechanisms for achieving its targets (i.e. the Quota System), and covers all HFCs (unlike Kigali, does not deal with issues such as equipment, certification, company registration, standards or training related to F-gases, and which does not cover F-gases such as hydrofluoroolefins).<sup>37</sup>

## The Work of the Committee

14. The main themes that the Committee covered were UK progress in reducing F-gas emissions, the regulation and enforcement of F-gas regulations and the implications of the UK's withdrawal from the EU, particularly for devolution and the UK's international commitments regarding F-gases. The terms of reference for this report can be found on our website. We held three public hearings with the Chairman of the Committee on Climate Change, academics, NGOs, industry representatives, the Environment Agency and the NHS Sustainable Development Unit and Dr Thérèse Coffey MP, Parliamentary Under Secretary of State, Department for Environment, Food and Rural Affairs. We received 14 pieces of written evidence which are published on our website. We are grateful to all those who gave evidence to this inquiry. We would also like to thank Aaron Goater (Committee on Climate Change), Françoise Spencer (Office of Speaker's Counsel) and Alistair Dillon (European Scrutiny Committee) for their advice on technical aspects of this inquiry.

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36 Confirmed by DEFRA in correspondence. Details of the Multilateral Fund for the Implementation of the Montreal Protocol can be found at: <http://www.multilateralfund.org/default.aspx>.

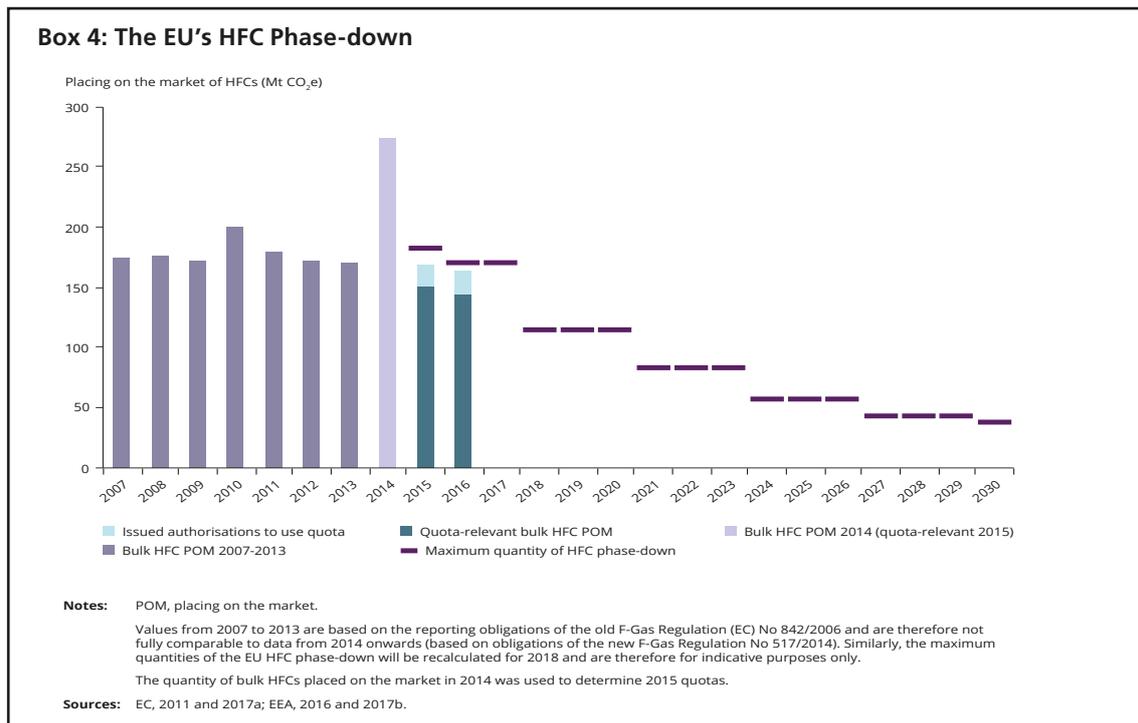
37 RFG0010 (Dr Ezra Clark); RFG0014 (Dr Annalisa Savaresi).

## 2 Progress on reducing F-gases

15. We found that progress on reducing use of F-gases was mixed. F-gas emissions are covered by two policy frameworks: the EU’s HFC Quota, and the UK’s carbon budgets, which are legislated for under the Climate Change Act 2008. One of the key EU measures we looked at is based on reducing the amount of HFCs on the EU market—i.e. the HFC Quota. The UK measures we considered concern estimated F-gas emission reductions and the role they play in reducing the UK’s overall GHG emissions. We also explored several areas where the UK could go further and faster in switching to lower GWP alternatives. In this section we explore EU-wide progress reducing F-gas emissions against EU targets, and the UK’s progress against the UK’s legally binding carbon budgets.

### Progress in hitting the EU’s HFC Quota

16. In 2017 the European Environment Agency (EEA) reported the first EU-wide decline (4%) of F-gases in 15 years.<sup>38</sup> However, the main emphasis of the EU’s approach has been a phase-down in the availability of HFCs, which are the most widely used F-gases, predominantly found in applications such as refrigeration and air conditioning. The phase-down started in 2015 and was implemented through an EU quota system and HFC registry.<sup>39</sup> The targets set for this phase-down and the progress so far are set out in Box 4.<sup>40</sup>



38 EEA, *Fluorinated greenhouse gases 2017*, (2017) p 5. The EEA note that there has been decline in the EU supply of higher GWP HFCs, replaced by lower GWP HFCs, and a reduction in very high GWP F-gases such as SF<sub>6</sub>, which were slightly offset an increase in NF<sub>3</sub>, which has a high GWP.

39 The HFC quota system applies to companies across the EU and not pro-rata by member state. Only companies with an HFC quota received from the European Commission are permitted to produce a specified amount of HFCs or import them into the EU. Most of the quotas were given to ‘incumbent companies’ that produced HFCs during the period 2009 to 2012 and are based on a company’s previous activity. A small proportion (11%) is allocated to ‘new entrants’ and quotas allocated to incumbents can be sold. Quota sizes fall every three years to deliver the phase-down. See: European Commission, [F-gas Portal: Quota allocation, authorisation and reporting](#), (accessed 8 February 2018) and Gluckman Consulting, [Information Sheet 28: The HFC Phase-Down Process](#), (2015).

40 EEA, *Fluorinated greenhouse gases 2017*, (2017), p 6.

17. The European Environment Agency (EEA), has reported modest reductions in HFCs. The EU Quota system set a baseline for 2015, based on an average estimate of HFC demand between 2009 and 2012 and then decreasing market limits for HFCs placed on the market for subsequent years. In 2015, the EU over-achieved, with a reduction of 8% below the market limit. In 2016, when a small cut was applied to the HFC quota, there was a reduction 4% below the market limit. The Minister also told us that since 2010, there had been an overall reduction in HFC supply of 18%.<sup>41</sup> However, we were told by the Chair of the Committee on Climate Change, Lord Deben, that this reflected a lack of ambition by the EU in setting more demanding targets,<sup>42</sup> while it was also suggested that the reductions in 2015 and 2016 might have been partly as a result of HFC stockpiling before the quota was introduced.<sup>43</sup> While industry maintained that some sectors in the UK were making progress on reducing reliance on high GWP refrigerants,<sup>44</sup> there was an acknowledgement that these cuts had occurred in advance of bigger and more challenging cuts due in 2018 and 2021.<sup>45</sup> It therefore remains to be seen if the EU will make these deeper cuts.<sup>46</sup>

18. Witnesses agreed that the Quota system was working and driving up the prices of high GWP refrigerants.<sup>47</sup> However, they had concerns as to whether such price rises, and a contraction in available refrigerants, might drive illegal sourcing of high GWP refrigerants outside of the HFC Quota,<sup>48</sup> or the dangerous retrofitting of systems to take lower cost refrigerants.<sup>49</sup> They were particularly concerned that, although the Government and trade associations have run campaigns about the need to prepare for reductions in availability,

41 [Q151](#) Dr Thérèse Coffey (Parliamentary Under-Secretary of State, Department for Environment, Food and Rural Affairs).

42 [Q4](#) Lord Deben (Committee on Climate Change).

43 [Q66](#) Clare Perry (Environmental Investigation Agency).

44 [Q68](#) Graeme Fox (REFCOM). He noted that larger supermarkets in the UK were making the move to lower CO<sub>2</sub> (GWP 1) refrigerants. See also [Q69](#) and [Q71](#) Martyn Cooper (Federation of Environmental Trade Associations); [RFG0013](#) (Environmental Investigation Agency); [RFG0009](#) (DEFRA).

45 [Q66](#) Clare Perry (Environmental Investigation Agency); [Q70](#) Martyn Cooper (Federation of Environmental Trade Associations). [RFG0013](#) (Environmental Investigation Agency).

46 See: Andrew Gaved, [Europe prepares for perfect storm over F-gas](#), MultiBriefs, (February 2018). He notes growing concern across Europe about a growing crisis over the contraction in, and attendant price rises for, key HFCs, such as R410A and R404A, which are widely used high GWP refrigerants.

47 [Q70](#) Martyn Cooper (Federation of Environmental Trade Associations). He noted that the most used high-GWP refrigerant had increased by about 700% since the HFC Quota had been introduced. See also: European Commission, [Assessing the quota allocation method in accordance with Regulation \(EU\) No 517/2014](#), COM(2017) 377 final, (July 2017); Cooling Post, [High GWP gases face 30% price increase](#), (March 2017); Carel, [Refrigerant prices: what is happening?](#), (March 2017). Andrew Gaved (see above) notes that one impact of the increase in the price of higher GWP refrigerants has been a move by key representative industry bodies in Europe to call upon European installers to stop using such refrigerants.

48 [Q110](#) Clare Perry (Environmental Investigation Agency). She noted that there was no real-time quota information to track quotas, especially in relation to imports, and that China and other countries were stockpiling high GWP refrigerants, which could lead to an illegal trade that could mirror the trade in illegal CFCs in the 1980s. [Q111](#) Graeme Fox (REFCOM) and [Q119–120](#) Martyn Cooper (Federation of Environmental Trade Associations). See also: [RFG0007](#) (Air Conditioning and Refrigeration Industry Board) and [RFG0008](#) (REFCOM). Both ACRIB and REFCOM pointed to a number of potential loopholes with UK F-gas regulations, including a lack of mandatory record keeping for several aspects of the regulations and a poorly resourced Environmental Agency to ensure compliance.

49 [Q92](#) Graeme Fox (REFCOM).

some UK SMEs might not have got this message and made the necessary preparations.<sup>50</sup> This also needs to be considered alongside witnesses' concerns about the resourcing of the Environment Agency and its ability to ensure compliance.<sup>51</sup>

**19. We welcome the fact that the EU overachieved the 2015 and 2016 HFC Quota targets and that there is evidence of price rises for higher GWP refrigerants as their availability is restricted. However, the targets were fairly unambitious and it remains to be seen whether UK companies, especially SMEs, are prepared for the big cuts required in 2018 and 2021. There is a danger this year that some businesses will find that they will not be able to access the refrigerants that they need and may be tempted to acquire them illegally. This would pose a challenge for the Environment Agency in monitoring and enforcing compliance. We are concerned that the Environment Agency may lack the resources it will need to police and enforce F-gas regulations, especially when it is also preparing to take on new responsibilities as the UK leaves the EU. *If the UK can meet the steeper cuts in 2018 and 2021, the Government should find ways to cut F-gas emissions even further.***

## F-gases, the UK Carbon Budgets and Green House Gas Emissions

20. At a UK level, reductions in F-gas emissions contribute to meeting overall UK GHG emissions reductions targets under the Climate Change Act 2008. The UK is currently set to miss its Fourth and Fifth Carbon Budgets, which cover the period 2023–27, and 2027–32 respectively.<sup>52</sup> The CCC has set out a pathway for reducing F-gases at least cost as part of the overall reductions in GHG emissions,<sup>53</sup> recommending that the UK should go further than the EU's 2015 F-gas Regulation and introduce stronger enforcement.<sup>54</sup> The CCC's analysis published in July 2017 and the evidence provided by its Chair, suggests that there is a danger that the UK is moving away from its suggested, cost-effective pathway,<sup>55</sup> which could have a negative effect on the UK's overall GHG emissions strategy.<sup>56</sup> In its 2017 Progress Report to Parliament, the CCC concluded "the broad trend in emissions since 2007 has been upwards and needs to be reversed. The rate of emissions reductions now needed to meet the indicator trajectory is quite steep, so considerable further progress is needed."<sup>57</sup> The CCC Chairman also told us that the UK is not maximising opportunities

50 [Q75](#) Clare Perry (Environmental Investigation Agency); [Q76–79](#) Martyn Cooper (Federation of Environmental Trade Associations).

51 [Q119–Q120](#) Martyn Cooper (Federation of Environmental Trade Associations). [Q24–26](#) Lord Deben (Committee on Climate Change) argued that the Environment Agency was not properly resourced more generally, currently and historically. See also: [RFG0007](#) (Air Conditioning and Refrigeration Industry Board) and [RFG0008](#) (REFCOM).

52 The CCC published [An independent assessment of the UK's Clean Growth Strategy](#) in January 2018. It found significant gaps in the Government's policies to meet the targets set for the Carbon Budgets, including targets agreed by the Paris Agreement: See also: Grantham Research Institute on Climate Change and the Environment, [New projections confirm Clean Growth Strategy cannot currently achieve Carbon Budgets](#), (January 2018); Carbon Brief, [The UK will miss its legally binding climate goals without more ambitious policies, says the Committee on Climate Change \(CCC\)](#), (January 2018). For an overview of the Carbon Budgets, the role of the Committee on Climate Change and progress so far see: House of Commons Library, [UK Fifth Carbon Budget](#), (December 2017).

53 CCC, [Sectoral scenarios for the Fifth Carbon Budget Technical report](#), (2015), p 213.

54 CCC, [Meeting Carbon Budgets - 2016 Progress Report to Parliament](#), (2016), pp 214–225. The CCC called upon the Government to look at low GWP alternatives for a range of applications and noted that several EU countries had gone further than the UK, including the use of taxes, additional bans or funding for research and deployment of low GWP alternatives. The CCC was concerned firstly that the UK should make more progress but also that progress was not based on 'soft' policies that might not deliver the targets set by the EU.

55 CCC, [Meeting Carbon Budgets: Closing the policy gap 2017 Report to Parliament](#), (July 2017), p 165.

56 [Q40](#) Lord Deben (Committee on Climate Change).

57 CCC, [Meeting Carbon Budgets: Closing the policy gap 2017 Report to Parliament](#), (July 2017), p.170.

to move to lower GWP alternatives where they exist and could be introduced relatively easily.<sup>58</sup> This was supported by others who put forward options such as additional taxes, green procurement, funding for lower GWP alternatives and correcting contradictory policies such as high GWP refrigerants in Government subsidised renewable heat pumps.<sup>59</sup>

21. Industry representatives told us that the current F-gas regime, if enforced correctly, is already challenging and that obstacles remain,<sup>60</sup> and that lower GWP refrigerants risked trade-offs with safety and energy efficiency.<sup>61</sup> The Minister agreed that taxes would push up the prices of high GWP HFCs but was not convinced that they were necessary as the current market was already leading to people switching to lower GWP HFCs.<sup>62</sup> Defra stated that they thought that the UK's current balance struck the right balance between environmental ambition and what was technically feasible and reasonable for businesses.<sup>63</sup>

**22. We are concerned that, despite the EU exceeding the 2015 and 2016 HFC Quota targets, the UK is in danger of moving away from the least-cost pathway that the Committee on Climate Change mapped out as part of the UK's overall efforts to reduce GHGs. While the market-based approach adopted by the EU is making progress, the Government should be prepared to consider other measures to help get the UK back on track to hit the Fourth and Fifth Carbon Budgets. As discussed in the following sections we believe that the Government can take further action to make more progress in reducing F-gases and particularly HFCs.**

### Specific examples where the Government could make more progress

23. We considered several areas where the Government could introduce alternative low GWP refrigerants relatively easily and where the Government could use policy levers to support the conversion to such refrigerants and propellants.

#### *Metered Dose Inhalers (MDIs)*

24. We took evidence on metered dose inhalers (MDIs), which are used for respiratory diseases, and typically use high GWP propellants and constitute the majority of inhalers prescribed in the UK. The [NHS Sustainable Development Unit](#) told us that MDIs represent 3.5% of the NHS's greenhouse gas emissions,<sup>64</sup> and estimate that about 70% of inhalers

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58 [Q1](#) and [Q40](#) Lord Deben (Committee on Climate Change).

59 [Q99](#) Clare Perry (Environmental Investigation Agency); [RFG0013](#) (Environmental Investigation Agency). The EIA noted that the review of the EU's F-gas Regulation in 2022 was the ideal point at which more stringent restrictions of high GWP HFCs could be introduced because the step downs in 2018 and 2022 represented significant cuts to HFC consumption to which industry needed to adjust.

60 [Q85](#) Martyn Cooper (Federation of Environmental Trade Associations). He was concerned that if the UK went further than the EU Phase-down it risked greater non-compliance. He also noted that there were problems with some alternatives in terms of flammability and toxicity, which required new systems to accommodate them. See also: [Q91](#) Martyn Cooper (Federation of Environmental Trade Associations); [RFG0008](#) (REFCOM); [RFG0007](#) (Air Conditioning and Refrigeration Industry Board); [RFG0006](#) (Airedale International Air Conditioning).

61 [Q96](#) to [Q98](#) Mike Nankivell (Air Conditioning and Refrigeration Industry Board); [Q85](#) Martyn Cooper (Federation of Environmental Trade Associations).

62 [Q186](#) to [Q188](#) Dr Thérèse Coffey (Parliamentary Under Secretary of State, Department for Environment, Food and Rural Affairs). See also [RFG009](#). Defra's submission stated that the UK had a large pool of expertise upon which to draw if the Government needed to assess new reduction measures and new low GWP alternatives, while the EU's phase-down was encouraging industry to undertake its own research and development of alternatives.

63 [RFG0009](#) (Defra).

64 [Q287](#).

dispensed in England are MDIs and just under 30% are Dry Powder inhalers (DPIs). They also estimate that over 35 million MDI inhalers are dispensed each year compared to 15 million DPIs. The majority of MDIs use HFA 134a as a propellant, which has a GWP of 1,480, while a small minority use HFA 227, which has a GWP of 2,800.<sup>65</sup> MDIs have been identified as a ‘carbon hotspot’ within the NHS.<sup>66</sup> MDIs are currently exempted from the EU’s F-gas Regulation. We heard that there are low GWP alternatives—dry powder inhalers (DPIs) which other countries, such as Sweden, prescribe in the majority of cases. GlaxoSmithKline told us: “It is not just Sweden; it is across most of Europe that the dry powder inhaler is the predominant inhaler.”<sup>67</sup> The evidence we took suggested that on balance DPIs if administered correctly deliver better clinical outcomes for many patients. The NHS Sustainable Development Unit told us:

“The error rate with a metered dose inhaler in clinical practice is that about 50% of patients cannot use them properly, whereas with the modern dry powder inhalers the error rate is down at about 10% or 20%. [...] the number of errors you make correlate with outcome. In other words, if you use an inhaler with a low error rate, even though in head-to-head clinical trials where they are used perfectly, there is no difference, in clinical practice you get a better outcome, for instance, better symptom control, less exacerbations of disease.”<sup>68</sup>

25. There was a consensus that DPIs may not be appropriate for certain groups, such as the elderly and the very young.<sup>69</sup> The witnesses did note that successful clinical outcomes for inhalers were also dependent on medical practitioner and patient education, so that

65 Information supplied by the NHS Sustainable Development Unit.

66 NHS Sustainable Development Unit, [Carbon Hotspots update for the health and care sector in England 2015](#), (January 2016), p 2–3. The SDU estimate MDI inhalers account for 3.5% of all NHS Emissions.

67 Q 273 Jerome Bradley (NHS Sustainable Development Unit); [RFG0005](#) (GlaxoSmithKline). See also: Toby Hillman et al., ‘Inhaled drugs and global warming: time to shift to dry powder inhalers’, *British Medical Journal*, Vol 346, (May 2013); British Thoracic Society, [The Environment and Lung Health](#), (January 2017); Lavorini, F et al, Retail sales of inhalation devices in European Countries: So much for a global policy, *Respiratory Medicine*, Vol 105, (2011), pp 1099–1103.

68 Q266 to Q267 Neil Barnes (GlaxoSmithKline) and Q278 Jerome Bradley (NHS Sustainable Development Unit) argued that there was a lower error rate with DPIs. Q278 to 279 and Q265 Stuart Corr (Mexichem) stated that DPIs did not have a 100% success rate and argued that decisions over DPIs and MDIs also had to take patient preference into account. He also pointed to evidence which suggested that patient choice and continuity could lead to improved clinical outcomes - see: Leif Bjermer, *The Importance of Continuity in Inhaler Device Choice for Asthma and Chronic Obstructive Pulmonary Disease*, *Respiration* Vol 88, (2014), pp 346–352. Dr Duncan Keeley ([RG0015](#)) maintained that some of the error rates associated with MDIs could be overcome by using MDIs with spacers. Chiesi ([RG0016](#)) argued that improvements in MDI technology were improving their effectiveness, which was leading to less propellant gas being lost to the atmosphere.

69 For instance, NICE has set out [guidance](#) on the use of MDIs and DPI for under-fives with chronic asthma, which states that clinical decisions should be based on the needs of individual needs of patients and their costs. NICE [guidance](#) for older children states that a range of inhalers can be considered based on the needs of the individual child. See also ([RFG0005](#) (GlaxoSmithKline); Q279 Stuart Corr (Mexichem). Dr Duncan Keeley ([RG0015](#)) noted that MDIs were the most effective treatment for patients with exacerbations of asthma or COPD that required substantially higher doses of inhaled bronchodilators. Dr Keeley also noted that MDIs were also more effectively used with spacers to improve the efficiency of delivery. Chiesi ([RG0016](#)) also stated that groups of patients were not able to generate the required level of inspiratory flow required to use DPIs. They also maintained that MDIs needed to remain a treatment option for asthma and COPD patients and in some cases the only option for some asthma and COPD patients.

the right technique was used.<sup>70</sup> We heard that the low take-up of DPIs was, in part, down to low awareness of DPIs as an alternative among patients and clinicians<sup>71</sup> and the higher costs of DPIs.<sup>72</sup> However, there were opportunities to raise greater awareness of DPIs and allow clinicians and patients to make informed choices, including the environmental impact of those choices. This included engagement with organisations such as the Royal College of GPs, the British Thoracic Society and NICE and promoting the NHS Sustainable Development Strategy, which had identified MDIs as a ‘carbon hotspot’.<sup>73</sup> We were told that the higher costs of DPIs could be offset by their greater efficiency, while greater uptake of DPIs would reduce their costs in the longer term.<sup>74</sup> Research is ongoing to produce low GWP MDIs, though they are still several years from being introduced,<sup>75</sup> and that there are efforts to make MDIs more efficient.<sup>76</sup>

26. We were also told that out of the tens of millions of MDIs that are prescribed in England, only a small proportion are collected to recycle. The NHS told us: “... we have calculated that about 0.5% have come back through the scheme.”<sup>77</sup> This raises the prospect of millions of MDIs ending up in landfill each year, where, over time, they will release residual high GWP HFCs into the atmosphere. We also heard that these residual HFCs could be reclaimed and reused for other purposes, as reused HFCs are outside of the HFC Quota.<sup>78</sup>

***27. We recommend that low GWP inhalers should be promoted within the NHS unless there are specific medical reasons for not doing so. Promotion should include raising awareness of low GWP inhalers and training amongst NICE, the medical community and patients. The NHS should set a target that by 2022 at least 50% of prescribed***

70 Q267 and Q281-Q282 Neil Barnes (GlaxoSmithKline); Q279 Jerome Bradley (NHS Sustainable Development Unit). The issue of using the correct technique has been raised for both types of inhalers. For example, see: Joaquin Sanchis et al, [Systematic Review of Errors in Inhaler Use: Has Patient Technique Improved Over Time?](#), *Respiratory Care*, Vol 150, No 2, (2016), pp. 394–406; BBC News, [Asthma and allergy devices ‘not used properly’](#), (December 2014); The Inhaler Error Steering Committee, [Inhaler competence in asthma: Common errors, barriers to use and recommended solutions](#), *Respiratory Medicine*, Vol 107, (2013), pp 37–46.

71 Q259 and Q281 to Q282 Neil Barnes (GlaxoSmithKline); Q268 and Q273 Jerome Bradley (NHS Sustainable Development Unit).

72 Q273 Stuart Corr (Mexichem). Some indication of the price difference between MDIs and DPIs can be found in: Regional Drug and Therapeutics Centre (Newcastle), [Cost Comparison Charts](#), (October 2017), Table 3.2, p 20. Dr Duncan Keeley (RG0015) provided evidence that the cost of DPI delivery could be 2–4 times the cost of MDI delivery for one key short acting bronchodilator (SABA) salbutamol which was used for relieving symptom of wheezing for both asthma and COPD. He noted that DPIs were currently more expensive for the delivery of other medications, though for others the cost differential was less. Chiesi (RG0016) also highlighted the challenges of current higher prices for many DPIs and also the costs associated with ensuring that medical staff were properly trained to show how DPIs could be used effectively and safely by patients. They too highlighted higher costs associated with the use of salbutamol (SABA) in DPIs versus MDIs.

73 Q283 to Q286 Jerome Bradley (NHS Sustainable Development Unit). See: NHS Sustainable Development Unit, [Carbon Hotspots update for the health and care sector in England 2015](#), (January 2016), p 2–3

74 Q276 Jerome Bradley (NHS Sustainable Development Unit) stated that because DPIs were more efficient, initial greater costs for DPIs could be offset by the need for fewer inhalers and hospital admissions.

75 Q266 Stuart Corr (Mexichem) noted that Mexichem was developing an MDI using HFC 152a, which has a GWP of 120 and which he thought would be available from 2021. See also [RFG0011](#) (Mexichem). Similar work on lower GWP MDIs is also being carried out by AstraZeneca. Chiesi (RG0016) also noted that replacing propellants in MDIs was a complex process, such as issues over toxicity, adaptation of hardware delivery systems and increased costs. It is investing in this area but acknowledged it would take time for these innovations to appear on the market.

76 Q269 Stuart Corr (Mexichem).

77 Q297 Jerome Bradley (NHS Sustainable Development Unit) stated that the NHS SDU estimated that only about 0.5% were collected. Q291 to Q296 Neil Barnes (GlaxoSmithKline) noted that it ran the only collection and recycling scheme and had recycled 1 million MDIs over a five-year period.

78 Q303 Stuart Corr (Mexichem) noted that reclaimed HFCs could for instance be reused as a refrigerant. Chiesi (RG0016) noted in its evidence that it was assessing how it could support waste management initiatives.

*inhalers are low GWP. It should publish annual progress reports. We were disappointed to find that so few MDIs are disposed of responsibly. We therefore recommend that the Government should work with medical professionals, pharmacists, the pharmaceutical industry and patients to significantly improve the recycling of MDIs; this makes both environmental and economic sense. The Government should ensure that by 2020, at least 50% of MDIs are recycled. The Government should publish annual data showing progress in reaching and exceeding this target. It should also consider medical waste, such as MDIs, in its waste strategy.*

### **Heat Pumps and HFCs**

28. We heard from the CCC and others about concerns that heat pumps, which are promoted as a way of reducing carbon emissions and supported through the Government's Renewable Heat Incentive, typically use high GWP refrigerants.<sup>79</sup> The Government has also identified heat pumps as having the potential to help deliver its Clean Growth Strategy.<sup>80</sup> The EU's F-gas Regulation does not include a ban on the use of high GWP refrigerants in heat pumps.<sup>81</sup> It seems paradoxical to us that a taxpayer-supported initiative aimed at reducing carbon emissions should rely on substances that, if released, would increase such emissions. We acknowledge that there is a trade-off between the use of high GWP refrigerants and the energy efficiency of the units they service.<sup>82</sup> However, we feel that there is an opportunity to reduce reliance on such substances and improve energy efficiency at the same time.<sup>83</sup> Defra told us that they have funded a range of information sheets to promote heat pump equipment that uses lower GWP HFCs.<sup>84</sup> However, we are not convinced by the Government's stance that the phase-down will naturally lead to reduced reliance on such gases in heat pumps.<sup>85</sup>

**29. *The Government should ensure that heat pumps use low GWP refrigerants. The Government should reform the Renewable Heat Incentive schemes so that they encourage the deployment of heat pumps that use low GWP refrigerants, and that by 2020 all publicly-funded heat pump projects use low GWP refrigerants. It should publish annual data indicating which gases are being used in heat pumps so that Parliament and the Committee on Climate Change can track performance in this area.***

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79 CCC, [Meeting Carbon Budgets: Closing the policy gap](#), p 169. The Committee noted its concerns that uptake of heat pumps, if they continued to use high GWP refrigerants could lead to "significant increases in F-gas emissions. See also Q99 Clare Perry (Environmental Investigation Agency). See also Ecologist, [Why 'eco-friendly' heat pumps increase, not reduce, your carbon footprint](#), (2010). For information on the Renewable Energy Initiative see: Energy Saving Trust, [Renewable Heat Incentive](#), (accessed 10 February 2018). For an overview of heat pump technology see: Parliamentary Office of Science and Technology, [Residential Heat Pumps](#), (2013). Defra supplied us with information which indicates that the most widely used refrigerant HFC410A has a GWP of 2088. Other refrigerants include: HFC-134a (GWP 1,430); R-404A (GWP 3,922) and R-407C (GWP 1,774). Alternatives include R32 (GWP 675).

80 BEIS, [The Clean Growth Strategy: Leading the way to a low carbon future](#), (October 2017), p 75. See also Carbon Brief, [In-depth: How the 'Clean Growth Strategy' hopes to deliver UK climate goals](#), (October 2017)

81 Q99 Clare Perry (Environmental Investigation Agency). See Defra, [Bans on F gas in new equipment](#), (accessed 17 February 2018).

82 Q97–98 Mike Nankivell (Air Conditioning and Refrigeration Industry Board).

83 Q210 to Q211 Davinder Lail (DEFRA); Q99 Clare Perry (Environmental Investigation Agency).

84 Information provided by Defra.

85 Q183 Dr Thérèse Coffey (Parliamentary Under Secretary of State, Department for Environment, Food and Rural Affairs). See also Q99 Graeme Fox (REFCOM). He argued that a reduction in the supply of the main refrigerant used in heat pumps—HF 410A (GWP 2088), because of the Phase-Down would lead to higher prices and a switch to R-32 (GWP 675).

### **Government Procurement and F-gases: Tracking Progress**

30. Several witnesses suggested that the Government could use its considerable procurement power (over £276bn in 2016–17),<sup>86</sup> to help create a market for appliances which use low GWP refrigerants.<sup>87</sup> The Minister noted that the Government’s Buying Standards ban the purchase of refrigeration and air conditioning units using high GWP refrigerants.<sup>88</sup> This Committee has carried out sustainability audits of several government departments.<sup>89</sup> Its most recent audit looked at the Ministry of Justice, including how it manages its sizeable estate, building new prisons, refurbishment projects, and the closure of older prisons and courts.<sup>90</sup> These audits have looked at a range of indicators that the Government is using, including its Greening Commitments, to cut GHG emissions.<sup>91</sup> These indicators do not split out the progress that the Government is making on reducing the use of high GWP refrigerants.

***31. Government departments should lead from the front on reducing their environmental impact. The Greening Commitments set targets and measures for GHG emission reductions: We recommend that they should be amended include targets for departments to reduce their consumption of products containing high GWP F-gases.***

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86 See HM Treasury, [Statistical Bulletin: Public Spending Statistics November 2017](#), (November 2017), Table 11, p 22.

87 Q93 Clare Perry (Environmental Investigation Agency). See also [RFG0013](#) (Environmental Investigation Agency).

88 Q190 Dr Thérèse Coffey (Parliamentary Under-Secretary of State, Department for Environment, Food and Rural Affairs). For details of the Government Buying Standards see: DEFRA, [Sustainable procurement: the GBS for electrical goods](#), (accessed 12 February 2018).

89 The audits include: [HM Treasury](#); [Department for Transport](#); [Home Office](#); [Department for Business, Innovation and Skills \(BIS\)](#).

90 EAC, [The Ministry of Justice: Environmental Sustainability](#), (HC 545; February 2018)

91 See DEFRA and Cabinet Office, [Greening Government Commitments Overview of reporting requirements 2016–2020](#), (December 2016) and DEFRA and Cabinet Office, [Greening Government Commitments Annual Report, April 2016 to March 2017](#), (February 2018).

### 3 Enforcement of F-gas Regulations and the MAC Directive

32. We heard from witnesses on a range of concerns related to the current regime. This included non-compliance, inadequate resourcing for regulators and a fear that steeper cuts in HFCs due in 2018 and 2021 and additional responsibilities for UK regulators when the UK leaves the EU will put more strain on the system. We also took evidence on the Government's plans to introduce civil penalties for F-gas breaches, which the Government hopes will increase the number of successful prosecutions and deter non-compliance. We also uncovered inconsistencies in the way F-gases are regulated, some of which we were told resulted from the framing of the MAC Directive.

#### Non-Compliance and resourcing of the current F-gas Regime in the UK

33. We heard concerns from industry and others that the Environment Agency was not adequately resourced to ensure compliance with regulations.<sup>92</sup> One industry witness pointed to non-compliant items and activities being advertised online. REFCOM's Graeme Fox told us "Euro Car Parts in particular is selling [gas] and they are not checking if that person is qualified."<sup>93</sup> They were particularly worried that high GWP refrigerants and appliances containing them will become attractive when steeper reductions in HFCs emissions are introduced in 2018 and 2021, with UK ports a potential weakness in the regime.<sup>94</sup> Industry witnesses were concerned that non-compliance put businesses that did comply at a competitive disadvantage. They argued this undermined the overall system.<sup>95</sup> Although the Environment Agency told us that they monitored social media and had had over 40 investigations into compliance,<sup>96</sup> there has been only one successful prosecution, which resulted from a company reporting its own breach.<sup>97</sup> The Minister stated that the Environment Agency and DEFRA are liaising with HMRC to ensure sharing of information to check imports and enforce compliance.<sup>98</sup>

**34. We were disturbed to hear from industry and others that they suspect large levels of non-compliance. We are concerned that the Environment Agency does not have the adequate resources to tackle this problem. The low number of investigations**

92 Q111 and Q118 Graeme Fox (REFCOM); Q119 to Q120 Martyn Cooper (Federation of Environmental Trade Associations); Q128 and Q129 Mike Nankivell (Air Conditioning and Refrigeration Industry Board); Q26 Lord Deben (Committee on Climate Change). See also: RFG0007 (Air Conditioning and Refrigeration Industry Board) and RFG0008 (REFCOM); RFG006 (Airedale International Air Conditioning Ltd).

93 Q146–148 Graeme Fox (REFCOM).

94 Q110 Clare Perry (Environmental Investigation Agency); Q91 Graeme Fox (REFCOM). For an overview of concerns about the possible international supply of HFCs see: Graham Donnelly Welch, HFC Smuggling: Preventing the Illicit (and Lucrative) Sale of Greenhouse Gases, Vol 44, No 2, (2017), pp 525–558.

95 Q130 Mike Nankivell (Air Conditioning and Refrigeration Industry Board); Q119 Martyn Cooper (Federation of Environmental Trade Associations); Q144 to Q146 Graeme Fox (REFCOM).

96 Q154 Dr Thérèse Coffey (Parliamentary Under Secretary of State, Department for Environment, Food and Rural Affairs) and Q157 and Q223 Liz Parks (Environment Agency). They noted that the Environment Agency had received 44 tip offs since 2015 and monitored social media sites, such as Amazon and eBay. DEFRA also provided additional information. It noted that over the past 12 months the Environment Agency's online surveillance had led to the removal of 198 banned products from sale and it contacting 56 retailers that were not advising their customers of the requirement to hold certification when purchasing HFC refrigerants.

97 Q157 Liz Parks (Environment Agency). The offence occurred in 2013 and resulted in a £3,000 fine.

98 Q168 Dr Thérèse Coffey (Parliamentary Under Secretary of State, Department for Environment, Food and Rural Affairs).

and the single prosecution for a self-reported breach since the beginning of 2015, when the current F-gas Regulation came into effect, do not inspire confidence. This is especially concerning with deeper cuts in HFCs due in 2018 and 2021 and if the Environment Agency is to take on additional responsibilities as result of leaving the EU's HFC Quota system in addition to the range of EU exit-related work it is already undertaking. *DEFRA and the Environment Agency should publish plans for monitoring non-compliance, especially on social media sites, and how they will ensure with HMRC that there are no weaknesses in the F-gas regime now and after the UK leaves the EU. Online sellers have the tools to end environmental criminality on their platforms. They should use them.*

### Introducing civil penalties for F-gas breaches

35. We were told by the Environment Agency that the low level of prosecutions was in part due to only criminal sanctions being available, which made the burden of proof much higher.<sup>99</sup> The Government has brought forward a new regime which relies on civil rather than criminal penalties.<sup>100</sup> The new regime replaces all but one of the existing thirteen criminal sanctions with civil penalties in England, Scotland and offshore; a criminal offence will be retained for the intentional release of fluorinated greenhouse gases into the atmosphere (where the release is not technically necessary for the intended use).<sup>101</sup> The intention is that this will increase the number of prosecutions and act as a deterrent. However, several witnesses questioned why so many criminal penalties have been removed, pointing to other environmental regulations, such as those proposed for mercury, where civil penalties are combined with a wider range of criminal penalties.<sup>102</sup>

36. **The introduction of civil penalties may increase the number of prosecutions and deter non-compliance. However, without a properly resourced regime, prosecutions will be difficult. We question the Government's decision not to retain more criminal sanctions, which would have added to the deterrence effect for non-compliance, especially for the worst offences. We recommend that the Government reviews the effectiveness of the F-gas compliance regime annually, indicating the actions it is taking, the resource it is assigning to such activities, the number of investigations carried out and the number of successful prosecutions achieved.**

99 Q222 to Q224 Liz Parkes (Environment Agency). See also: DEFRA, [Consultation - Introducing civil penalties for infringements of the Fluorinated Greenhouse Gases Regulation](#), (October 2017). The consultation also stated that pursuing criminal sanctions were costly and time intensive, which also mitigated against successful prosecutions. Since 2015, there has been only one successful prosecution. Schneider Electric was fined £3,000 and £18,368 costs for self-reporting a release of 15kg of sulphur hexafluoride (SF<sub>6</sub>) gas (GWP 22,800) into the air from high voltage switchgear being installed at London Gateway Port in Essex. See: Refcom, [Refcom welcomes successful F gas prosecution](#), (April 2016).

100 See: <http://www.legislation.gov.uk/ukxi/2018/98/made>.

101 The new civil penalties include fines up to £200,000.

102 Q59 Professor Richard Macrory; Q126 Clare Perry (Environmental Investigation Agency). For the Government's proposals on mercury see: DEFRA and BEIS, [A consultation on the proposed Control of Mercury \(Enforcement\) Regulations 2017](#), (October 2017). The Regulations were introduced in December 2017: <http://www.legislation.gov.uk/ukxi/2017/1200/introduction/made>. The Environment Agency noted that it had applied civil penalties to the [EU Emissions Trading Scheme](#) and the [CRC Energy Efficiency Scheme](#) and had served 180 civil sanctions since—Q222 Liz Parkes.

## Inconsistencies in who can handle F-gases

37. We took evidence on non-registered mechanics handling high GWP refrigerants, which are used in car air conditioning systems. There was a particular concern that such mechanics might substitute cheap higher GWP refrigerants for more expensive lower GWP alternatives.<sup>103</sup> Conversely, we also heard that as the EU Quota drove up the prices of high GWP refrigerants, some engineers were retrofitting mildly flammable lower GWP refrigerants into older non-flammable car air conditioning units, which could be dangerous.<sup>104</sup> We were surprised when DEFRA told us that the MAC Directive allows members of the public to top-up their car air conditioning units with high GWP refrigerants,<sup>105</sup> though it is illegal for them to recover HFCs or use top-up HFCs for other purposes.<sup>106</sup>

**38. It is essential that anybody who handles top-up refrigerants for car air conditioning units should be trained, certificated and monitored. Otherwise there is a real danger that high GWP HFCs will be discharged into the atmosphere. This appears in part a result of the wording of the Mobile Air Conditioning (MAC) Directive. The Government should set out how it will correct this deficiency and ensure that only qualified mechanics handle refrigerants for car air conditioning units.**

39. We also heard more general problems relating to the training of those registered to use high GWP refrigerants.<sup>107</sup> We were told that those trained under the old F-gas Regulation were not taught about low GWP alternatives.<sup>108</sup> Furthermore, the new F-gas Regulation, which included training on the application of low GWP refrigerants, did not stipulate that there should be retrospective training.<sup>109</sup> This is a particular problem because as the EU's phase-down begins to bite it will lead to a demand for lower GWP alternatives, which in turn will require trained and qualified technicians who are familiar with their use.<sup>110</sup> The Government have said that it will monitor whether enough resources are in place to ensure F-gas compliance, both in terms of business as usual activities and those resulting from the UK's exit from the EU. They told us that: "Assessments of future resource needs for these activities will be made as part of future spending reviews".<sup>111</sup>

103 Q148 Clare Perry (Clare Perry (Environmental Investigation Agency) and Q143 and Q146 to Q147 Graeme Fox (REFCOM).

104 Q92 Graeme Fox (REFCOM). He mentioned engineers putting the lower GWP and mildly flammable R32 into systems designed to use R-410A, because the price of R-410A had risen by 300% in a few months.

105 Q146 and Q147 Graeme Fox (REFCOM). He argued that this undermined the training of engineers and the need for qualified persons to handle F-gases. For example, we found a range of over-the-counter air conditioning top up refrigerant for sale at stores such as [Halfords](#) and online at [Amazon](#) and [e-Bay](#).

106 Information supplied by Defra.

107 See Defra, [Qualifications required to work on equipment containing F gas](#), (accessed 18 February 2018). Individuals working on systems and equipment containing fluorinated greenhouse gases regulated by the EU must be qualified. There are different qualifications for stationary refrigeration and air conditioning (SRAC systems), including heat pump systems; stationary fire protection systems; mobile air conditioning systems; electrical switchgear; solvent recovery. Businesses that work on third party systems or equipment, must ensure that their engineers have personal qualification and must also have a company F-gas certificate. Sole traders must also have a personal qualification and a company F-gas certificate. See also: Gluckman Consulting, [EU F-gas Regulation](#), (accessed 18 February 2018), for fact sheets on training and qualifications for different sectors.

108 Q84 Graeme Fox (REFCOM).

109 As above.

110 RFG0007 (Air Conditioning and Refrigeration Industry Board). This will include the move from the widely used refrigerant R4108 (GWP 2088) to R32 (GWP 675).

111 RFG0009 (Defra).

40. **The fact that thousands of qualified engineers are not trained in relation to low GWP refrigerants is inhibiting the switch to low GWP alternatives. *The Government should consult with industry and bring forward proposals to ensure that all those who handle refrigerants have up-to-date training.***

41. We were surprised to hear that it was legal in 2017 for unqualified people to buy high GWP “technical aerosols” from high street retailers for an array of uses, such as freezing pipes and cleaning computer keyboards.<sup>112</sup> However, from 1 January 2018 the sale of these products has been banned.<sup>113</sup> We note the Environment Agency’s assurances that it monitors illegal online and over-the-counter selling of such products.<sup>114</sup> However, enforcing new rules will represent an additional responsibility for the Environment Agency, which we have heard is already stretched.

42. **We are pleased that technical aerosols using high GWP refrigerants will now be banned. However, we do not believe the Environment Agency has the resources to ensure compliance in this area while it is preparing to take on additional responsibilities as the UK leaves the EU. *The Government should provide more detail in response to this report, on how it will police these banned products and how this will be resourced.***

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112 Q238 to Q241 Davinder Lail (Defra).

113 Defra, [Bans on F gas in new equipment](#), (accessed 17 February 2018). This will include any aerosol with a GWP greater than 150 but will exclude if the HFCs used are required to meet national safety standards or for medical applications.

114 Q223 and Q232 to 238 Liz Parkes (Environment Agency).

## 4 The Impact of leaving the EU on the UK's F-gas Regime

43. We considered a number of issues related to the UK leaving the EU and the impact this might have on the UK's regulation of F-gases. This included: what system will be in place after the UK leaves the EU; what scope there will be for the UK to diverge from the EU and whether this is desirable; whether F-gas regulation will be affected by trade deal negotiations; whether there will be divergence on F-gas policies between the devolved administrations and Westminster; the implications for the UK's international environmental agreements.

### Options for regulating F-gases after the UK leaves the UK

44. As the UK leaves the EU, depending on the outcome of the negotiations, there will be several options as to how it regulates F-gases. The Minister told us that this includes staying in the EU quota system for a transitional period or until the end of the phase-down in 2030 or the UK setting up its own system.<sup>115</sup> The Government have stated that the UK will continue to use a quota system to phase down HFCs and to follow the same phase-down schedule as the current EU regulation and use 2022 as a review point to assess whether the UK was still on track and to take corrective action if required.<sup>116</sup> Discussions are ongoing with the European Commission as to how the UK can split out its quota from the overall EU quota.<sup>117</sup> The UK Government state that the Commission's initial thinking would require UK companies to set up an office or appoint a representative in the EU:

Their initial ideas would entail UK companies continuing to be allocated EU quota so they could continue to supply the EU market on the same terms as other non-EU quota holders currently do (such as Chinese and US companies which hold EU quota). That would require UK companies to set up an office or appoint an only representative in the EU.<sup>118</sup>

45. EU F-gas legislation sets targets for 2030, whereas the Kigali Amendment sets targets for 2036. The EU therefore plans to revise its legislation in 2022 to bridge the gap between 2030 and 2036. The EU (Withdrawal) Bill will cut and paste the 2014 F-gas Regulation into UK law on exit day, before this review takes place. If the Government decide to seek to retain regulatory alignment with the EU's F-Gas policies as part of the agreement on a future relationship, then the UK risks becoming a rule-taker and not a rule-maker in this area of policy.

46. The Government asserts that if there were separate UK and EU systems, this would be a relatively small additional administrative burden for businesses.<sup>119</sup> However, industry told us that they would prefer the UK to stay in the EU's quota system and feared the higher costs associated with two systems. REFCOM's Graeme Fox told us that staying part of the EU's regime "would probably be ideal in global terms from an equipment

115 Q162 Dr Thérèse Coffey (Parliamentary Under Secretary of State, Department for Environment, Food and Rural Affairs).

116 Q178 Dr Thérèse Coffey (Parliamentary Under Secretary of State, Department for Environment, Food and Rural Affairs). The 2022 Review point is also built into the EU's HFC Quota System.

117 Defra, Initial European Commission ideas on how to split the EU and UK F-gas quota system, (October 2017).

118 As Above.

119 RFG0009 (Defra).

manufacturing point of view”.<sup>120</sup> We heard from others that the EU’s quota system is stronger than the Kigali Amendment proposals,<sup>121</sup> because not only does it push for deeper cuts up until 2030 but it stipulates how that target would be reached and the mechanism to achieve it. None of our witnesses believed that the UK should introduce weaker targets than the current EU quota system.<sup>122</sup> While industry witnesses believed that the current system was strong enough,<sup>123</sup> several, including the Chairman of the CCC, thought that a separate UK system offered opportunities to go further and faster.<sup>124</sup>

47. A key element of the EU’s approach to reducing F-gas emissions is the HFC Phase-down, which depends on the EU’s HFC quota system and F-gas registry. UK Environmental Law Association queried whether UK producers and importers would continue to have access to the F-gas registry and quota system after the UK leaves the EU. Access to this system will not be decided by the EU (Withdrawal) Bill, but by the outcome of the negotiations.<sup>125</sup>

**48. There does not appear to be any appetite for the UK to leave the EU’s F-gas regulatory regime. The Government have said that they are planning for several scenarios, including the UK establishing its own F-gas system based on the EU’s regime. We welcome the Government’s commitment that it has no intention of lowering current emission targets. However, we do not believe that it would be a good deal for the UK if it were to replicate the EU system without a say on the rules that govern it, whilst businesses would be subject to the additional costs that two regulatory systems would impose. Businesses need certainty about whether the UK will remain in the EU system during the transitional period. We therefore recommend that the UK should seek to remain part of the EU’s quota system. This will not prevent the UK Government from being more ambitious in its efforts to reduce F-gas emissions through the measures outlined above. If, however, the Government decides to leave the EU system, it must set out concrete proposals showing how it will be able to achieve more progress on F-gases.**

## Replacing EU regulatory and oversight bodies if the UK leaves the EU’s regulatory regime

49. We believe that the UK should remain part of the EU’s F-gas regime. However, if the UK decides to leave and institute its own regime this will require new or existing bodies to take on additional responsibilities.<sup>126</sup> The Secretary of State has issued a ministerial direction authorising expenditure as part of preparations for ‘no deal’ exit from the EU without a transition period.<sup>127</sup> This includes authorisation for the department to spend £0.5m on the development of a UK system to manage the UK’s quota of HFCs, F-gases and ozone depleting substances (CFCs).<sup>128</sup> Defra told us: “if the current quota system were to be split into separate UK and EU systems, businesses would face a relatively small additional administrative burden of reporting to two systems.”<sup>129</sup> The Environment

120 Q131 Graeme Fox (REFCOM) and Q131 to Q132 Martyn Cooper (Federation of Environmental Trade Associations).

121 For a summary of the Kigali Amendment proposals see Box 2, p 13.

122 For example: Q141 Martyn Cooper (Federation of Environmental Trade Associations); RFG0011 (Mexichem); RFG0002 (Pure Cold Ltd) supported the phase-down but not the quota approach and preferred the use of a tax on high GWP HFCs instead.

123 Q137 Graeme Fox (REFCOM).

124 Q85 and Q138 Clare Perry (Environmental Investigation Agency).

125 RFG0012

126 RFG0014 (Dr Annalisa Savaresi).

127 See: <https://www.gov.uk/government/publications/eu-exit-preparations-ministerial-direction>.

128 As above.

129 RFG0009

Agency told us that it has estimated that it will cost £250K to set up an IT system to run a UK HFC quota.<sup>130</sup> The Environment Agency told us that they believed they had the resources to run the existing regime and to take on new responsibilities if the UK decided to set up its own system.<sup>131</sup>

**50. *Setting up a UK-based system may represent poor value for money for the UK taxpayer. In its response to this report, the Government should set out its assessment of how much funding would be required to run and police a UK-based system. The Government should publish a fully costed proposal for a UK scheme, including its assessment of the expected additional costs to taxpayers, businesses and the NHS of setting up a UK-based own system. We note that the track record of government IT projects staying within budget is not good, so we have little confidence that the £250K allocated to run a UK system will be sufficient.***

51. We warned in our previous report—The Future of the Natural Environment after the EU Referendum, about the dangers of ‘zombie legislation’ and the prospect of transposed EU law not being updated or enforced by an appropriate governance body.<sup>132</sup> We are therefore concerned as to how the Government will replicate the overarching oversight currently provided by the European Environment Agency, the European Commission and the European Court of Justice to ensure that the UK Government keeps to its commitments and enforces compliance.<sup>133</sup> We were told that the Environment Agency and regulators in the other nations will become the enforcement bodies and that the Government will consult in early 2018 on the overall governance structure and the environmental principles that will underpin it.<sup>134</sup>

52. We heard evidence that the MAC Directive may have been incorrectly, or not completely transposed into UK law. Unlike EU Regulations, which are directly applicable EU law, Directives must be transposed into UK law, usually through statutory instruments made under section 2 of the European Communities Act 1972. UK Environmental Law Association told us that parts of the MAC Directive have not been transposed: “Article 4(2) of the mobile air-conditioning directive requires member states to ensure that manufacturers supply information on the type of refrigerant used in air-conditioning systems fitted to new motor vehicles. We cannot find [...] any national legislation directly reflecting that.” The Government have said that the EU (Withdrawal) Bill will ensure that “the same rules and laws will apply the day after exit day as they did before”.<sup>135</sup> However, as UKELA pointed out in their evidence, the EU (Withdrawal) Bill will not cut and paste Directives which have not been transposed into UK law,<sup>136</sup> meaning parts of the MAC Directive could be lost after exit day.

130 Q172 Liz Parkes (Environment Agency).

131 Q168 to Q175 Liz Parkes (Environment Agency); RFG0009 (Defra).

132 EAC, [The Future of the Natural Environment after the EU Referendum](#), (HC 599; January 2017), pp 15–20.

133 Same as above. See also: Q42 Dr Annalisa Savaresi; RFG0014 (Dr Annalisa Savaresi). Professor Richard Macrory and Andrew Jordan in their evidence to the Lords EU Energy and Environment Sub Committee, feared that in the absence of EU institutions there might be an over-reliance on judicial review, which is expensive and time-consuming—House of Lords EU Energy and Environment Sub-Committee, [Brexit: Environment and Climate Change: Corrected Oral Evidence](#), Wednesday 26 October 2016, Q10.

134 Q176 Liz Parkes (Environment Agency) and Dr Thérèse Coffey (Parliamentary Under-Secretary of State, Department for Environment, Food and Rural Affairs). See Defra, [New environmental protections to deliver a Green Brexit](#), (November 2017). See also: Maria Lee, [5 Governance Principles for Making Environmental Law after Brexit, Brexit and Environment](#), (January February 2018).

135 HC Deb 07 September 2017 vol 628 col 342

136 Q55

53. It is essential that there is independent oversight of Government policy to ensure the UK meets its obligations, for instance hitting HFC reduction targets agreed under the EU's quota and under the Kigali Amendment to the Montreal Protocol.<sup>137</sup> We have separately called for evidence on the Government's proposals for the structures and principles which will underpin the governance of environmental policy across a range of areas, including F-gases. We welcome the Environment Secretary's promised consultation on a new statutory body to enforce environmental law after exit day but we are concerned by its delay. *We reiterate our previous recommendation for an Environmental Protection Act before the UK leaves the EU to ensure that EU environmental law does not end up as 'zombie legislation', whereby EU legislation transposed into UK law is not monitored, updated or enforced because it relies on EU policies and institutions. The Government's approach to the EU (Withdrawal) Bill should recognise this risk.*

### F-gases and Trade Deals

54. A number of witnesses, including the Chair of the Committee on Climate Change, expressed concern that the UK might be put under pressure to lower its targets on reducing high GWP HFCs as a bargaining position for agreeing bilateral trade deals. Lord Deben told us:

“The most difficult thing in that trade [negotiation] is keeping standards up. If you are trying to negotiate, as I did with the United States, the United States does not agree that we should be able to say what the standards of the things that they sell to us are [...]. They do not see that we are the purchasers. If it is a question of a trade deal, you have to accept that the United States does not go in for accepting higher standards on the other side, which they see as a trading block. It has been longstanding; it is not just Mr Trump. It has always been true. That is why we have never been able to get a sensible deal with the United States on a whole range of things [...].”<sup>138</sup>

55. This might include trade deals with countries who have lower standards or who have stockpiled large amounts of higher GWP refrigerants.<sup>139</sup>

56. **We welcome the Secretary of State's remarks to our Committee and elsewhere that he will not allow trade talks to dilute the UK's environmental standards.<sup>140</sup> Reducing high GWP HFCs are part of the commitments we have made under the current EU targets (which the Government has said it will honour after we leave the EU) the Kigali Amendment to the Montreal Protocol and forms part of the package under the Kyoto Protocol and Paris Agreement to reduce our GHG emissions. We will hold the Government to their commitments.**

137 See Box 2, p 13 for a summary of the Montreal Protocol and Kigali Amendment to the Protocol.

138 Q28 Lord Deben (Committee on Climate Change). See also on wider concerns that leaving the EU might lower the UK's environmental standards: James Trapper, [Britain risks losing green protections after Brexit](#), The Guardian, (January 2018).

139 Q110 Clare Perry (Environmental Investigation Agency).

140 See EAC, [Oral evidence: The Government's Environmental Policy](#), (HC 544; November 2017), Q99 and. EAC, [Letter from the Secretary of State to the Chair concerning the Government's Environment Policy](#), 30 November 2017. See also: Business Green, [Michael Gove backs post-Brexit adoption of 'environmental principles'](#), (January 2018). The Minister also confirmed to the Committee that the Government had no intention of lowering any EU emission standards as result of trade deals—Q166 Dr Thérèse Coffey (Parliamentary Under Secretary of State, Department for Environment, Food and Rural Affairs).

57. If the UK leaves the EU Quota system, it will have to agree with the rest of the EU the proportion of the quota that UK companies will take with them. Once outside the EU system, UK companies will not be able to trade quotas with their European counterparts. This would remove the flexibility UK businesses have within the EU Quota system. Leaving the EU Quota system would also remove the flexibility of third countries who would lose their flexibility to trade their quota with the EU, and they may not welcome this. We note that any deal that would allow the UK to continue to participate in the EU's quota system as a non-Member State would have to be agreed by third countries as well as the EU. This challenge may also apply to the EU's Emissions Trading Scheme.<sup>141</sup>

58. *Though we recommend that the UK should remain within the EU's HFC Quota system, if the Government decides to leave the EU's HFC Quota system it must set out how UK businesses will manage their HFC quotas and not be put at a commercial disadvantage in relation to their European counterparts.*

## Leaving the EU and Devolution

59. After the UK leaves the EU, the level playing field across the UK provided by the EU's F-gas Regulation and HFC Quota system might be replaced by policy divergence between the devolved legislatures of the UK.<sup>142</sup> This is because, with the repeal of the European Communities Act 1972, the duty upon the devolved institutions not to act incompatibly with EU law will be removed. Without any provision made expressly by UK primary legislation, the devolved legislatures will be free to legislate in those areas of devolved competence, such as the environment, which had previously fallen under the jurisdiction of the EU and been subject to the primacy of EU law.<sup>143</sup> The refrigeration industry told us that they feared such divergence might lead to additional costs if different policies and requirements applied in the different nations of the UK.<sup>144</sup> The Minister agreed that separate regulations for the different nations of the UK would be challenging for business and that one system for the whole of the UK would be preferable.<sup>145</sup> However, she told us that negotiations were ongoing between the UK Government and the devolved Administrations and that no agreement had been reached on how a UK-wide system

141 See for example: Richard S J Tol, Policy Brief—Leaving an Emissions Trading Scheme: Implications for the United Kingdom and the European Union, Review of Environmental Economics and Policy, Volume 12, Issue 1, 1 February 2018, pp 183–89; Baran Doda, [Should the UK stay or should it go? The consequences of a divorce with the EU ETS](#), Grantham Research Institute on Climate Change and the Environment, (February 2017).

142 For a discussion of how leaving the EU might impact on devolved environmental matters see: Greener UK, [Brexit and devolution: implications for intra-UK environmental governance](#), (November 2017) House of Lords EU Energy and Environment Sub-Committee, [Brexit: environment and climate change](#), (HL Paper 109), pp 50–53. For an overview of how leaving the EU might impact upon devolution more generally see for example: House of Commons Public Administration and Constitutional Affairs Committee, [Devolution and Exiting the EU and Clause 11 of the European Union \(Withdrawal\) Bill: Issues](#), (HC 484; November 2017); Richard Rawlings, [BREXIT AND THE TERRITORIAL CONSTITUTION: Devolution, Reregulation and Inter-governmental Relations](#), The Constitution Unit, (July 2017); Akash Paun and George Miller, [Four-nation Brexit: How the UK and devolved governments should work together on leaving the EU](#), Institute for Government, (October 2016); Robert Hazell and Alan Renwick, [Brexit: Its Consequences for Devolution and the Union](#), UCL Constitution Unit, (May 2016);

143 See: House of Lords Committee on the Constitution, [The 'Great Repeal Bill and Delegated Powers](#), (HL Paper 123; March 2017), para 112, p 35. See also House of Lords European Union Committee, [Brexit: Devolution](#), (HL Paper 9; July 2017), p 3; House of Lords Committee on the Constitution, [European Union \(Withdrawal\) Bill](#), (HL Paper 69; January 2018).

144 Q149 Graeme Fox (REFCOM) and Martyn Cooper (Federation of Environmental Trade Associations).

145 Q192 Dr Thérèse Coffey (Parliamentary Under-Secretary of State, Department for Environment, Food and Rural Affairs).

might be managed.<sup>146</sup> She suggested that companies might present their concerns to the devolved Administrations, she told us: “I would encourage industry to speak to the Governments of Scotland, Wales and Northern Ireland to encourage them to say one system would be good.”<sup>147</sup> However, the Government has stated that in the absence of an agreement on a range of devolved issues, including F-gases, where it believes national frameworks are required, it has decided to temporarily retain powers following the UK leaving the EU.<sup>148</sup>

**60. The Government and the devolved administrations need to be pro-active in developing UK systems of future environmental enforcement as the UK leaves the EU. The ongoing uncertainty, along with the challenges that withdrawal from the EU Quota system pose, creates uncertainty for industry. We agree with the Minister that it would be best to have an overarching body to set and monitor UK-wide F-gas targets, based on a consensual agreement between the devolved legislatures and Westminster. The Government should publish in its response to this report a timetable for negotiating with the devolved Administrations on how F-gas emissions will be managed after the UK leaves the EU.**

61. Another aspect of devolution that we considered was the position of Northern Ireland and “full regulatory alignment”, whereby Northern Ireland would have ongoing alignment with the Republic of Ireland, and by implication the EU, to avoid a hard border while at the same time maintaining alignment with the rest of the UK.<sup>149</sup> There has been much debate as to how and whether these two things can be reconciled if the UK has a different regulatory regime from the EU.<sup>150</sup> The answers to these questions are beyond the scope of this inquiry. However, the Government has indicated that the environment is an area where full regulatory alignment would apply.<sup>151</sup>

**62. We are concerned that, if UK and EU policies diverge in the future, Northern Ireland could become a back door for appliances containing F-gases which have been restricted or banned on only one side of the border.**

146 Q192 and Q193 Dr Thérèse Coffey (Parliamentary Under-Secretary of State, Department for Environment, Food and Rural Affairs).

147 Q193 Dr Thérèse Coffey (Parliamentary Under-Secretary of State, Department for Environment, Food and Rural Affairs).

148 See Defra, [UK Government to table devolution amendments to EU Withdrawal Bill](#), (8 March 2018). The Government’s analysis of which areas should be temporarily retained and not temporarily retained can be found [here](#). For commentary and analysis see: BBC News, [UK ministers want temporary control of devolved areas post-Brexit](#), (March 2018); Daily Telegraph, [UK Government publishes ‘cast iron’ evidence Brexit will deliver significant new powers to Scotland](#), (March 2018); The Guardian, [UK to table new offer on post-Brexit powers for Scotland and Wales](#), (March 2018).

149 For a discussion on the meaning of ‘regulatory alignment’, see: BBC News, [Brexit: What is regulatory alignment?](#), (December 2017); David Allen Green, [Brexit: what regulatory alignment means and does not mean](#), Financial Times, (December 2017).

150 See House of Commons Library, [Brexit: ‘sufficient progress to move to phase 2’](#), (December 2017), pp 31–41; House of Lords Library, [Leaving the EU: Role of the Devolved Administrations and Implications for the Union](#), (January 2018), pp 16–18; Anthony Costello, [The UK needs to clarify what ‘full regulatory alignment’ means before the next phase of the Brexit talks](#), LSE European Institute, (January 2018); Business Green, [Could the Irish border hold the key to a green Brexit?](#), (December 2017).

151 The Prime Minister noted on 11 December 2017 that the environment would be one of six sectors, alongside waste and water management, the electricity market, agriculture, and questions relating to road and rail transport, where there would be ‘full regulatory alignment’. HC Hansard, 11 December 2017, [col 38](#).

## The UK and International Environmental Agreements

63. We heard from several academic experts on whether the UK's withdrawal from the EU might cast doubt on its continued membership of mixed multilateral international environmental treaties, such as the Montreal Protocol, where both the UK and the EU have signed such agreements.<sup>152</sup> We were told that it was not explicitly clear where the split between the competences assumed by the EU and UK lay.<sup>153</sup> There was agreement that it was unlikely that the UK would drop out of the Montreal Protocol,<sup>154</sup> and that if this did happen it should be relatively straightforward for the UK to reapply.<sup>155</sup> However, we were cautioned that more complex agreements, such as the Kyoto Protocol, will be more challenging.<sup>156</sup> The academics maintained that the UK's withdrawal from the EU and its impact on the status of the UK's international environment agreements represented "uncharted waters",<sup>157</sup> and that uncertainty had not been adequately addressed by the Government.<sup>158</sup> They suggested that the Government could undertake and publish legal analysis on the status of mixed multilateral international environmental agreements as the UK leaves the EU,<sup>159</sup> and produce a joint statement with the EU to clarify that the UK was fully assuming those competences under those treaties.<sup>160</sup> The Minister told us that previous Government statements sufficed and that a further statement would not add anything.<sup>161</sup> In February 2018, the Government published a technical note on international agreements, which proposed that third country agreements, which apply to the UK in its capacity as an EU Member should continue to apply to the UK as it left the EU.<sup>162</sup> However, this applies to bilateral agreements and not mixed multilateral agreements and only for the transition period, not after the UK has left the EU.

**64. Whilst it seems unlikely that the UK will drop out of the Montreal Protocol and similar international multilateral mixed environmental agreements when it leaves the EU, there is nevertheless uncertainty as to what will happen after exit day. Some complex international agreements, such as the Kyoto Protocol, will a present significant**

152 For a discussion of mixed multilateral international environmental agreements and the debate about how they might be affected by the UK leaving the EU see: House of Commons Library, [Brexit and Environmental Law; The UK and International Environmental Law after Brexit](#), (January 2018), pp 4–10 and pp 22–40. See also: UKELA, [Brexit and Environmental Law: The UK and International Environmental Law after Brexit](#), (September 2017); House of Commons Library, [Legislating for Brexit: EU External Agreements](#), (5 January 2017); Reed Smith Client Alerts, [Brexit: Implications for Environmental Law](#), (6 October);

153 Q42 Professor Panos Koutrakos; RFG0014 (Dr Annalisa Savaresi).

154 Q44 and Q45 Professor Richard Macrory. Q47 Dr Annalisa Savaresi noted that it was unlikely that the UK would drop out of mixed multilateral international environmental agreements because by their very nature they were inclusive to achieve their global goals.

155 Q52 and Q53 Dr Annalisa Savaresi. Q47 Professor Richard Macrory noted that if there was a dispute between exiting parties to the Montreal Protocol or other mixed multilateral international environmental agreements, the UK would have recourse to a dispute resolution mechanism via the Vienna Convention and ultimately the International Court of Justice. Q47 Dr Savaresi suggested that in the first instance the UK could use the Meeting of Parties of a mixed international environmental agreement to settle a dispute.

156 Q42 Professor Panos Koutrakos; Q44 and Q50 Professor Richard Macrory; Q51 Dr Annalisa Savaresi; RFG0014 (Dr Annalisa Savaresi); RFG0014 (Dr Annalisa Savaresi).

157 Q54 Dr Annalisa Savaresi; RFG0012 (UKELA) See also: House of Lords EU Energy and Environment Sub-Committee, [Brexit: Environment and Climate Change: Corrected Oral Evidence](#), Wednesday 26 October 2016, Q10 (Professor Richard Macrory). Professor Macrory highlighted differences of opinion between legal experts.

158 Q45 and Q46 Professor Richard Macrory; RFG0012 (UKELA).

159 Q48 Professor Richard Macrory.

160 Q48 and Q50 Professor Richard Macrory; Q49 Professor Panos Koutrakos; Q50 Dr Annalisa Savaresi; RFG0014 (Dr Annalisa Savaresi).

161 Q203 Dr Thérèse Coffey (Parliamentary Under Secretary of State, Department for Environment, Food and Rural Affairs); RFG0009 (Defra).

162 Department for Exiting the European Union, [Technical note on international agreements](#), (February 2018).

***challenge. The Government should undertake and publish legal analysis on the status of the UK's international environmental treaties after it leaves the EU within two months of this Report being published. The Government should also give serious consideration to issuing a joint statement with the EU to provide clarity that the UK will fully assume its obligations under these treaties.***

## Conclusions and recommendations

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### Progress on reducing F-gases

1. We welcome the fact that the EU overachieved the 2015 and 2016 HFC Quota targets and that there is evidence of price rises for higher GWP refrigerants as their availability is restricted. However, the targets were fairly unambitious and it remains to be seen whether UK companies, especially SMEs, are prepared for the big cuts required in 2018 and 2021. There is a danger this year that some businesses will find that they will not be able to access the refrigerants that they need and may be tempted to acquire them illegally. This would pose a challenge for the Environment Agency in monitoring and enforcing compliance. We are concerned that the Environment Agency may lack the resources it will need to police and enforce F-gas regulations, especially when it is also preparing to take on new responsibilities as the UK leaves the EU. *If the UK can meet the steeper cuts in 2018 and 2021, the Government should find ways to cut F-gas emissions even further.* (Paragraph 19)
2. We are concerned that, despite the EU exceeding the 2015 and 2016 HFC Quota targets, the UK is in danger of moving away from the least-cost pathway that the Committee on Climate Change mapped out as part of the UK's overall efforts to reduce GHGs. While the market-based approach adopted by the EU is making progress, the Government should be prepared to consider other measures to help get the UK back on track to hit the Fourth and Fifth Carbon Budgets. As discussed in the following sections we believe that the Government can take further action to make more progress in reducing F-gases and particularly HFCs. (Paragraph 22)
3. *We recommend that low GWP inhalers should be promoted within the NHS unless there are specific medical reasons for not doing so. Promotion should include raising awareness of low GWP inhalers and training amongst NICE, the medical community and patients. The NHS should set a target that by 2022 at least 50% of prescribed inhalers are low GWP. It should publish annual progress reports. We were disappointed to find that so few MDIs are disposed of responsibly. We therefore recommend that the Government should work with medical professionals, pharmacists, the pharmaceutical industry and patients to significantly improve the recycling of MDIs; this makes both environmental and economic sense. The Government should ensure that by 2020, at least 50% of MDIs are recycled. The Government should publish annual data showing progress in reaching and exceeding this target. It should also consider medical waste, such as MDIs, in its waste strategy.* (Paragraph 27)
4. *The Government should ensure that heat pumps use low GWP refrigerants. The Government should reform the Renewable Heat Incentive schemes so that they encourage the deployment of heat pumps that use low GWP refrigerants, and that by 2020 all publicly-funded heat pump projects use low GWP refrigerants. It should publish annual data indicating which gases are being used in heat pumps so that Parliament and the Committee on Climate Change can track performance in this area.* (Paragraph 29)
5. *Government departments should lead from the front on reducing their environmental impact. The Greening Commitments set targets and measures for GHG emission*

*reductions: We recommend that they should be amended include targets for departments to reduce their consumption of products containing high GWP F-gases. (Paragraph 31)*

### Enforcement of F-gas Regulations and the MAC Directive

6. We were disturbed to hear from industry and others that they suspect large levels of non-compliance. We are concerned that the Environment Agency does not have the adequate resources to tackle this problem. The low number of investigations and the single prosecution for a self-reported breach since the beginning of 2015, when the current F-gas Regulation came into effect, do not inspire confidence. This is especially concerning with deeper cuts in HFCs due in 2018 and 2021 and if the Environment Agency is to take on additional responsibilities as result of leaving the EU's HFC Quota system in addition to the range of EU exit-related work it is already undertaking *DEFRA and the Environment Agency should publish plans for monitoring non-compliance, especially on social media sites, and how they will ensure with HMRC that there are no weaknesses in the F-gas regime now and after the UK leaves the EU. Online sellers have the tools to end environmental criminality on their platforms. They should use them.* (Paragraph 34)
7. The introduction of civil penalties may increase the number of prosecutions and deter non-compliance. However, without a properly resourced regime, prosecutions will be difficult. We question the Government's decision not to retain more criminal sanctions, which would have added to the deterrence effect for non-compliance, especially for the worst offences. *We recommend that the Government reviews the effectiveness of the F-gas compliance regime annually, indicating the actions it is taking, the resource it is assigning to such activities, the number of investigations carried out and the number of successful prosecutions achieved.* (Paragraph 36)
8. It is essential that anybody who handles top-up refrigerants for car air conditioning units should be trained, certificated and monitored. Otherwise there is a real danger that high GWP HFCs will be discharged into the atmosphere. This appears in part a result of the wording of the Mobile Air Conditioning (MAC) Directive. *The Government should set out how it will correct this deficiency and ensure that only qualified mechanics handle refrigerants for car air conditioning units.* (Paragraph 38)
9. The fact that thousands of qualified engineers are not trained in relation to low GWP refrigerants is inhibiting the switch to low GWP alternatives. *The Government should consult with industry and bring forward proposals to ensure that all those who handle refrigerants have up-to-date training.* (Paragraph 40)
10. We are pleased that technical aerosols using high GWP refrigerants will now be banned. However, we do not believe the Environment Agency has the resources to ensure compliance in this area while it is preparing to take on additional responsibilities as the UK leaves the EU. *The Government should provide more detail in response to this report, on how it will police these banned products and how this will be resourced.* (Paragraph 42)

## The Impact of leaving the EU on the UK's F-gas Regime

11. There does not appear to be any appetite for the UK to leave the EU's F-gas regulatory regime. The Government have said that they are planning for several scenarios, including the UK establishing its own F-gas system based on the EU's regime. We welcome the Government's commitment that it has no intention of lowering current emission targets. However, we do not believe that it would be a good deal for the UK if it were to replicate the EU system without a say on the rules that govern it, whilst businesses would be subject to the additional costs that two regulatory systems would impose. Businesses need certainty about whether the UK will remain in the EU system during the transitional period. *We therefore recommend that the UK should seek to remain part of the EU's quota system. This will not prevent the UK Government from being more ambitious in its efforts to reduce F-gas emissions through the measures outlined above. If, however, the Government decides to leave the EU system, it must set out concrete proposals showing how it will be able to achieve more progress on F-gases.* (Paragraph 48)
12. *Setting up a UK-based system may represent poor value for money for the UK taxpayer. In its response to this report, the Government should set out its assessment of how much funding would be required to run and police a UK-based system. The Government should publish a fully costed proposal for a UK scheme, including its assessment of the expected additional costs to taxpayers, businesses and the NHS of setting up a UK-based own system. We note that the track record of government IT projects staying within budget is not good, so we have little confidence that the £250K allocated to run a UK system will be sufficient.* (Paragraph 50)
13. It is essential that there is independent oversight of Government policy to ensure the UK meets its obligations, for instance hitting HFC reduction targets agreed under the EU's quota and under the Kigali Amendment to the Montreal Protocol. We have separately called for evidence on the Government's proposals for the structures and principles which will underpin the governance of environmental policy across a range of areas, including F-gases. We welcome the Environment Secretary's promised consultation on a new statutory body to enforce environmental law after exit day but we are concerned by its delay. *We reiterate our previous recommendation for an Environmental Protection Act before the UK leaves the EU to ensure that EU environmental law does not end up as 'zombie legislation', whereby EU legislation transposed into UK law is not monitored, updated or enforced because it relies on EU policies and institutions. The Government's approach to the EU (Withdrawal) Bill should recognise this risk.* (Paragraph 53)
14. We welcome the Secretary of State's remarks to our Committee and elsewhere that he will not allow trade talks to dilute the UK's environmental standards. Reducing high GWP HFCs are part of the commitments we have made under the current EU targets (which the Government has said it will honour after we leave the EU) the Kigali Amendment to the Montreal Protocol and forms part of the package under the Kyoto Protocol and Paris Agreement to reduce our GHG emissions. We will hold the Government to their commitments. (Paragraph 56)

15. *Though we recommend that the UK should remain within the EU's HFC Quota system, if the Government decides to leave the EU's HFC Quota system it must set out how UK businesses will manage their HFC quotas and not be put at a commercial disadvantage in relation to their European counterparts. (Paragraph 58)*
16. The Government and the devolved administrations need to be pro-active in developing UK systems of future environmental enforcement as the UK leaves the EU. The ongoing uncertainty, along with the challenges that withdrawal from the EU Quota system pose, creates uncertainty for industry. We agree with the Minister that it would be best to have an overarching body to set and monitor UK-wide F-gas targets, based on a consensual agreement between the devolved legislatures and Westminster. *The Government should publish in its response to this report a timetable for negotiating with the devolved Administrations on how F-gas emissions will be managed after the UK leaves the EU. (Paragraph 60)*
17. We are concerned that, if UK and EU policies diverge in the future, Northern Ireland could become a back door for appliances containing F-gases which have been restricted or banned on only one side of the border. (Paragraph 62)
18. Whilst it seems unlikely that the UK will drop out of the Montreal Protocol and similar international multilateral mixed environmental agreements when it leaves the EU, there is nevertheless uncertainty as to what will happen after exit day. Some complex international agreements, such as the Kyoto Protocol, will a present significant challenge. *The Government should undertake and publish legal analysis on the status of the UK's international environmental treaties after it leaves the EU within two months of this Report being published. The Government should also give serious consideration to issuing a joint statement with the EU to provide clarity that the UK will fully assume its obligations under these treaties. (Paragraph 64)*

## Appendix: F-gases

1) Fluorinated gases (F-gases) are artificial gases. There are four types: hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF<sub>6</sub>) and nitrogen trifluoride (NF<sub>3</sub>). The most widely used are HFCs, which account for about 95% of F-gas emissions, while SF<sub>6</sub> and PFCs account for roughly 3% and 2% of F-gas emissions respectively. NF<sub>3</sub> account for a very small amount of emissions.

### F-gas properties, applications and uses

#### *HFCs: General characteristics*

2) HFCs are mainly used as refrigerants in refrigeration, air conditioning and heat pump applications. They can also be used as a blowing agent in the production of insulation materials and as propellants in aerosols and medical appliances, such as inhalers. Though the Global Warming Potential (GWP) of some HFCs can be as great as 14,800 times that of carbon dioxide, the most widely used HFCs are substantially less, usually between 1,000 and 4,000, and can remain in the air for up to 270 years. One of the most widely used HFC refrigerants—HFC-134a has a GWP of 1,430 and persists for 20 years. Other key HFC refrigerants include: R-404A (GWP 3,922); HFC 507 (GWP 3985), R-410A (GWP 2,088) and R-407C (GWP 1,774). Examples of HFCs being used as blowing agents include HFC 245fa (GWP 950) or HFC 365mfc (GWP 794).

#### *HFCs and refrigeration*

3) HFCs are used in a variety of sectors for refrigeration purposes, which require different loads. Domestic refrigeration includes refrigerators, freezers and fridge/freezers and typically use between 0.05 and 0.25 kg of refrigerant, usually HFC 134a.<sup>163</sup> The commercial sector (e.g. supermarkets, petrol stations, small shops, pubs, hotels, restaurants) use a variety of appliances ranging from small hermetically sealed systems (e.g. ice cream freezers and stand-alone retail displays) to large central pack systems, used in supermarkets and large stores to cool numerous display cases. While small units may use between 0.1 Kg and 0.5 kg of HFC 134a or HFC 404A, a larger unit may use in excess of 100 kg of HFC 404A.<sup>164</sup> Industrial uses cover: food and drink; manufacturing; chemicals; petrochemicals; pharmaceuticals; printing; plastic mouldings. Industrial processes are also used in nonindustrial sectors such as cold storage, ice rinks and ski centres. Specific uses include large central systems serving several major loads (e.g. blast freezing and large cold stores), large chiller systems and smaller dedicated plants, each serving a single cooling appliance. Loads can range from several tonnes to less than a 100 kg of refrigerant, typically HFC 404A and HFC 507.<sup>165</sup> The transport sector is also a significant user of refrigerants, usually HFC 134a or HFC 404A, to transport chilled goods.<sup>166</sup>

163 Gluckman Consulting, [EU F-Gas Regulation Guidance: Information Sheet 1: Domestic Refrigeration](#), (2014). See also EFCTC, [Refrigeration](#), (accessed 26 February 2018).

164 Gluckman Consulting, [EU F-Gas Regulation Guidance Information Sheet 2: Commercial Refrigeration](#), (2014). See also EFCTC, [Refrigeration](#), (accessed 26 February 2018).

165 Gluckman Consulting, [EU F-Gas Regulation Guidance Information Sheet 3: Industrial Refrigeration](#), (Updated January 2015). See also EFCTC, [Refrigeration](#), (accessed 26 February 2018).

166 Gluckman Consulting, [EU F-Gas Regulation Guidance Information Sheet 4: Transport Refrigeration](#), (2014). See also EFCTC, [Refrigeration](#), (accessed 26 February 2018).

### **HFCs and air conditioning**

4) HFCs are also used in air conditioning appliances. Single split systems, which consist of an indoor cooling unit connected to an outdoor condensing unit (compressor and condenser) tend to use HFC 410A and a refrigerant charge of between 1 kg and 5 kg. Large split systems and packaged units, which includes a range of direct expansion air conditioning systems, also typically use HFC 410A with a refrigerant charge of between 5 and 50 kg. Chiller systems, which are usually used to cool large buildings, using chilled water as a secondary refrigerant, often use HFC 134a and have typical refrigerant charges between 50 kg and 500 kg. Systems which use smaller chillers might use HFC 410A or HFC 407C and have charges of between 5 kg and 50 Kg. Hermetically sealed movable air-conditioning systems.—small integral air-conditioning units that can be moved between different rooms in a building, usually use HFC 134a or HFC 410A and have refrigerant charges of well under 1 kg.<sup>167</sup> The mobile air conditioning sector is also a major user of HFCs, primarily HFC 134a, and covers road vehicles and other modes of transport such as trains, ships and aircraft.<sup>168</sup>

### **HFC in heat pumps and fire protection equipment**

5) HFCs refrigerants are also used in heat pump systems to absorb, transport and release heat.<sup>169</sup> This includes air source, ground source and water source heat pumps for building heating. Domestic systems often use HFC 410A and typically have a refrigerant charge between 3 kg and 5 kg. Larger systems, using various refrigerants, are used in commercial, industrial and public buildings. Other HFCs used in heat pumps include HFC 134a, R-404A and R-407C. HFCs also have uses in specialised fire protection equipment, where, for example, building contents have a high value and other fire protection systems could cause too much damage. They are also used as small automatic fire extinguishers (e.g. bus engines, small boat engines and motor sports) and as hand held extinguishers.<sup>170</sup>

### **Perfluorocarbons (PFCs)**

6) PFCs are a group of man-made chemicals containing the two elements carbon and fluorine. Under normal environmental conditions they are generally colourless, odourless, non-flammable, unreactive gases. The main releases of PFCs to the environment occur during the manufacture of semi-conductors, specialist refrigeration equipment and the production of aluminium.<sup>171</sup> They have a GWP of between 7,390 and 12,200.<sup>172</sup> PFCs are used as etching/cleaning gases in various microelectronic and semi-conductor manufacturing processes.<sup>173</sup> PFCs are also used to make fluoropolymer coatings that resist heat, oil, stains, grease, and water for a range of products such as clothing, furniture,

167 Gluckman Consulting, [EU F-Gas Regulation Guidance Information Sheet 5: Stationary Air-conditioning and Heat Pumps](#), (2014).

168 Gluckman Consulting, [EU F-Gas Regulation Guidance Information Sheet 6: Mobile Air-Conditioning](#), (2014).

169 See EFCTC, [Heat Pumps](#), (accessed 21 February 2018).

170 Gluckman Consulting, [EU F-Gas Regulation Guidance Information Sheet 10: Fire Protection Systems](#), (2014).

171 Scottish Environment Protection Agency, [Perfluorocarbons \(PFCs\)](#), (accessed 26 February 2018).

172 United States Environmental Protection Agency, [Overview of Greenhouse Gases](#), (accessed 26 February 2018).

173 Wen-TienTsa et al, [A review of uses, environmental hazards and recovery/recycle technologies of perfluorocarbons \(PFCs\) emissions from the semiconductor manufacturing processes](#), *Journal of Loss Prevention in the Process Industries*, Vol 15 Issue 2, (March 2002).

adhesives, food packaging, heat-resistant non-stick cooking surfaces, and the insulation of electrical wire. <sup>174</sup> They also have several medical and pharmaceutical uses, including blood substitution, ventilation and for delivery of gas-based therapeutics. <sup>175</sup>

### **Sulphur hexafluoride (SF<sub>6</sub>)**

7) SF<sub>6</sub> is an inorganic, colourless, odourless, non-corrosive and non-flammable gas. It is also an excellent electrical insulator. It has a GWP of 22,800. <sup>176</sup> SF<sub>6</sub> is used in the design of high and medium voltage switchgears because of its size and weight reduction and its quiet and reliable handling and maintenance. <sup>177</sup> It is also used for magnesium casting, as it helps form a protective atmosphere to prevent the formation of undesirable by-products. <sup>178</sup> Other foundry applications include aluminium casting and as a refining and degassing agent. <sup>179</sup> SF<sub>6</sub> is applied in the semi-conductor industry, as an etching gas for plasma etching or as a cleaning gas to clean the chambers after the etching process. <sup>180</sup> Several other minor industrial applications include leak detection as a tracer gas and the manufacture of loud speakers and lasers. Medical applications include its use as a contrast agent for ultrasound imaging and as an injection in vitreoretinal surgery to restore the vitreous chamber. <sup>181</sup>

### **Nitrogen Trifluoride (NF<sub>3</sub>)**

8) NF<sub>3</sub> is a colourless, odourless, non-flammable gas. It has a GWP of 17,200. <sup>182</sup> It is used as a cleaning agent in the plasma etching of silicon wafers and is predominantly applied to the manufacture of high-volume liquid-crystal displays and silicon-based thin-film solar cells. <sup>183</sup> It is also used in hydrogen fluoride and deuterium fluoride lasers, which are types of chemical lasers. <sup>184</sup>

174 See: Centers for Disease Control, [Perfluorochemicals \(PFCs\)](#), (accessed 20 February 2018).

175 See UNPCC, [Compilation of technical information on the new greenhouse gases and groups of gases included in the Fourth Assessment Report of the Intergovernmental Panel on Climate Change](#), (accessed 21 February 2018); MP Hlastala, and JE Souders, JE, "Perfluorocarbon Enhanced Gas Exchange: The easy way". *American Journal of Respiratory and Critical Care Medicine*. Vol 164 No 1 (July 2001), p 1–2.

176 United States Environmental Protection Agency, [Overview of Greenhouse Gases](#), (accessed 26 February 2018).

177 Gluckman Consulting, [EU F-Gas Regulation Guidance Information Sheet 11: High Voltage Switchgear](#), (2014) and EFCTC, [About Sulphur Hexafluoride \(SF<sub>6</sub>\)](#), (accessed 21 February 2018).

178 Gluckman Consulting, [EU F-Gas Regulation Guidance Information Sheet 12: Magnesium Smelting](#), (2014).

179 See: EFCTC, [Products & Applications of Sulphur Hexafluoride \(SF<sub>6</sub>\)](#), (accessed 20 February 2018).

180 As above.

181 See: PubChem, [Sulphur Hexafluoride](#), (accessed 20 February 2018).

182 United States Environmental Protection Agency, [Overview of Greenhouse Gases](#), (accessed 26 February 2018).

183 See: Air Products, [Nitrogen Trifluoride: Product Stewardship Summary](#), (accessed 26 February 2018) and Gas World, [Nitrogen trifluoride - Cleaning up in electronic applications](#), (July 2008); Prachi Patel-Predd, [Electronics Industry Changes the Climate with New Greenhouse Gas](#), *Scientific American*, (2008).

184 UNPCC, [Compilation of technical information on the new greenhouse gases and groups of gases included in the Fourth Assessment Report of the Intergovernmental Panel on Climate Change](#), (accessed 21 February 2018)

# Formal minutes

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**Wednesday 18 April 2018**

Members present.

Mary Creagh, in the Chair:

Colin Clark	John McNally
Zac Goldsmith	Dr Matthew Offord
Mr Robert Goodwill	Alex Sobel
Kerry McCarthy	

Draft Report (*UK progress on reducing F-gas emissions*), proposed by the Chair, brought up and read.

Paragraphs 1 to 64 read and agreed to.

Summary agreed to.

Appendix agreed to.

*Resolved*, That the Report be the Fifth Report of the Committee to the House.

*Ordered*, That the Chair make the Report to the House.

*Ordered*, That embargoed copies of the Report be made available, in accordance with the provisions of Standing Order No. 134.

[The Committee adjourned

## Witnesses

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The following witnesses gave evidence. Transcripts can be viewed on the [inquiry publications page](#) of the Committee's website.

### Tuesday 28 November 2018

**Lord Deben**, Chair of the Committee on Climate Change [Q1–40](#)

### Tuesday 5 December 2018

**Professor Richard Macrory**, University College London and UKELA; **Dr Annalisa Savaresi**, Stirling University; and **Professor Panos Koutrakos**, City University London [Q41–62](#)

**Martyn Cooper**, Commercial Manager, Federation of Environmental Trade Associations (FETA); **Mr Mike Nankivell**, Chairman, F-gas Implementation Group, Air Conditioning and Refrigeration Industry Board; **Graeme Fox**, Head of REFCOM Scheme; and **Clare Perry**, Climate Campaign Leader, Environmental Investigation Agency [Q63–149](#)

### Tuesday 12 December 2018

**Dr Thérèse Coffey MP**, Parliamentary Under-Secretary of State, Department for Environment, Food and Rural Affairs, **Liz Parkes**, Deputy Director for Climate Change and Business Services, Environment Agency, **Davinder Lail**, Team Leader, Ozone Depleting Substances and Fluorinated Gases, Department for Environment, Food and Rural Affairs [Q150–257](#)

**Jerome Baddley**, Head of NHS Sustainable Development Unit, **Richard Lomax**, Sustainability Projects Analyst and Programme Manager, NHS Sustainable Development Unit, **Neil Barnes**, Global Franchise Medical Head, Respiratory Franchise, GlaxoSmithKline, and **Stuart Corr**, Mexichem UK Ltd, Techno-Commercial Director [Q258–316](#)

## Published written evidence

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The following written evidence was received and can be viewed on the [inquiry publications page](#) of the Committee's website.

RFG numbers are generated by the evidence processing system and so may not be complete.

- 1 ACRIB - Air Conditioning and Refrigeration Industry Board ([RFG0007](#))
- 2 Airedale International Air Conditioning Ltd. ([RFG0006](#))
- 3 Bacharach, Inc. ([RFG0004](#))
- 4 Defra ([RFG0009](#))
- 5 Dr Annalisa Savaresi ([RFG0014](#))
- 6 Dr Duncan Keeley ([RFG0015](#))
- 7 Dr Ezra Clark ([RFG0010](#))
- 8 Environmental Investigation Agency ([RFG0013](#))
- 9 Federation of Environmental Trade Associations ([RFG0003](#))
- 10 GlaxoSmithKline ([RFG0005](#))
- 11 Mexichem UK Limited ([RFG0011](#))
- 12 Mr Nicholas Cox ([RFG0001](#))
- 13 Pure Cold Limited ([RFG0002](#))
- 14 REFCOM ([RFG0008](#))
- 15 UKELA ([RFG0012](#))

## List of Reports from the Committee during the current Parliament

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All publications from the Committee are available on the [publications page](#) of the Committee's website. The reference number of the Government's response to each Report is printed in brackets after the HC printing number.

### Session 2017–19

Fourth Report	Improving air quality	HC 433
Third Report	The Ministry of Justice: Environmental Sustainability	HC 545
Second Report	Disposable packaging: Coffee cups	HC 657
First Report	Disposable packaging: Plastic bottles	HC 339
First Special Report	The Future of Chemicals Regulation after the EU Referendum: Government Response to the Committee's Eleventh Report of Session 2016–17	HC 313
Second Special Report	Marine Protected Areas Revisited: Government Response to the Committee's Tenth Report of Session 2016–17	HC 314
Third Special Report	Sustainable Development Goals in the UK: Government Response to the Committee's Ninth Report of Session 2016–17	HC 616
Fourth Special Report	Plastic bottles: Turning Back the Plastic Tide: Government Response to the Committee's First Report	HC 841
Fifth Special Report	Disposable Packaging: Coffee Cups: Government's Response to the Committee's Second Report	HC 867