THE CROSS-GOVERNMENT GROUP ON
GAS SAFETY AND CARBON MONOXIDE AWARENESS

ANNUAL REPORT
AUTUMN 2019 TO AUTUMN 2020
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1. Introduction

Carbon monoxide (CO) poisoning is a serious and preventable form of poisoning. The health effects from CO exposure range from headaches, dizziness and cognitive impairments at low levels, and can cause serious health problems and even death at high levels.

CO is produced from the burning of any carbon-based fuel such as mains gas, liquefied petroleum gas, oil, coal, coke and wood, which are used in many household appliances. CO poisoning can occur when an appliance has been incorrectly fitted or used, badly repaired or poorly maintained. It can also occur if flues, chimneys, or vents are blocked.

There are over 23 million households or premises that use gas across the UK1, whilst many others use oil and solid fuel appliances. Around 8 million carbon monoxide alarms are currently installed in homes across England alone – a requirement when solid fuel appliances such as wood burning stoves and boilers are installed, as well as in private rental properties that feature a solid fuel appliance.

The statistics on pages 6-11 indicate that the trend for carbon monoxide poisonings has shown a general decrease. However, during 2019 an increase in fatal incidents has been seen; given the number of households/premises identified as using gas across the UK, we must guard against complacency.

Gas safety, and more broadly CO awareness, is a cross-Government issue, with the majority of Government Departments, the Devolved Administrations and other governmental bodies having an interest from their particular perspective.

2. Purpose

The Cross-Government Group was established to ensure a joined-up approach to improve gas safety and reduce carbon monoxide poisoning risks, leading to a sustained reduction in fatalities and ill-health. The Group’s activities include:

- sharing knowledge on gas safety and CO risk
- exploring innovative ways of delivering the necessary improvements in CO-awareness and reducing risks from gas and other fossil fuels; and
- reviewing industry progress in adopting a more pro-active, co-ordinated approach to improving understanding of gas safety issues generally

The purpose of this report is to explain the collective work of Government to improve gas safety and tackle the risks of CO from all fuels.

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3. Members of the group

- Department for Business, Energy & Industrial Strategy (BEIS)
- Ministry of Housing, Communities and Local Government (MHCLG)
- Health and Safety Executive (HSE)
- Health and Safety Executive for Northern Ireland (HSENI)
- Office of Gas and Electricity Markets (Ofgem)
- Public Health England (PHE)
- Department of Health and Social Care (DHSC)
- Public Health Wales (PHW)
- Welsh Government
- Scottish Government
- Health Protection Scotland (HPS)
- Home Office (HO)
- Department of Digital, Culture, Media and Sport (DCMS)

The role departments play in fuel safety and CO awareness

MHCLG
Making sure that people are safe and feel safe in their homes through a framework of rental & building safety regulations and guidance that is both effective and proportionate.

BEIS
Regulating the product safety framework for consumer goods & enforcing product safety relating to gas appliances through the Gas Appliances (Enforcement) and Miscellaneous Amendments Regulations 2018 (enforcing EU Regulation 2016/426 & the Gas Appliance (Safety) Regulations 1995.

OFGEM
Protecting the interest of gas & electricity consumers by promoting value for money, supervision & development of market competition & regulation & delivery of government schemes.

HSE & HSENI

PHE
Provides advice & raises public awareness of CO. Supports health professionals via the NPIS and smoking in pregnancy initiatives. Produces the ‘Cold Weather Plan’ & carries out original clinical research.

Home Office
Raises awareness of fire safety & is the sponsoring Department of Fire and Rescue services, supports them in their delivery of fire safety at the local level both in the home and workplace.

Welsh Government
Oversight of health protection policy and legislation within a Public Health remit.

Oversight of building regulations, including control of heat producing appliances, their ventilation & the effect on CO.
PHW
Working to achieve a healthier future for Wales through the delivery of seven strategic priorities. Organisational priorities reflect the focus of long-term prevention, integration, collaboration & involvement.

Scottish Government
Working through Scottish Ministers, Building Standards Division drafts the building standards & associated guidance within the Technical Handbooks. This includes standards relating to fixed combustion appliances.

HPS
Protecting the people of Scotland from infectious and environmental hazards by providing advice, support and information.

DHSC
Supporting ministers in leading the nation’s health and social care to help people live more independent, healthy lives.

DCMS
Protecting and promoting Britain’s cultural and artistic heritage and helping businesses and communities grow by investing in innovation.
4. Statistical evidence

This section includes statistical data from the Office for National Statistics (ONS), requested by Public Health England (PHE) on behalf of the Department of Health & Social Care (DHSC). It also includes data from Health Protection Scotland (HPS), Health and Safety Executive (HSE) and Health and Safety Executive for Northern Ireland (HSENI) on CO fatalities.

The various parties use specific, but different, criteria in what they record. The figures reflect the differences in the relevant data sources, as follows:

- The ONS, HPS and NI data in Tables 1, 2 and 3 is based on public health information and excludes self-harm where that has been coded, but it is likely that self-harm is under-reported.
- HSE collects data on incidents which are reportable under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013 (RIDDOR) www.hse.gov.uk/riddor/ (and previously under the 1995 Regulations). A sample of this data is provided at Table 4. The RIDDOR Regulations apply to events which arise out of, or in connection with, work activities covered by the Health and Safety at Work etc Act 1974. The Regulations require gas conveyors and Liquid Petroleum Gas (LPG) suppliers to report incidents where someone has died, lost consciousness, or been taken to hospital for treatment to an injury where gas is likely to be a cause.

CO mortality data

The ONS data on mortality from CO poisoning (deaths registered in 2018-2019 in England and Wales) is available online at www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/adhocs/12420numberofdeathsfromaccidentalpoisoningbycarbonmonoxideenglandandwalesdeathsregisteredin2019 (reference 12420).

According to ONS statistics there were around 20 deaths from accidental CO poisoning in England and Wales over the last three years. The figure dropped from around 30 deaths in 2015 and 2016, to around 20 deaths reported in 2017, 2018 and 2019.

PHE has compiled mortality statistics from ONS for accidental poisoning 2015-2019. Data from 2011-2019 is presented in Table 3 below.

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2 The figure of ‘around 20 deaths a year’ used in this report is based on a rolling average for five years (2014-2018), for the average number of accidental poisonings by other gases and vapours (X47) and where the secondary cause of death was the toxic effect of carbon monoxide (T58).
### Table 1: England and Wales - mortality figures 2011-2019

#### Number of deaths from accidental poisoning by carbon monoxide, England and Wales

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</tr>
</thead>
<tbody>
<tr>
<td>V01-X59</td>
<td>All accidental carbon monoxide poisonings</td>
<td>79</td>
<td>65</td>
<td>60</td>
<td>55</td>
<td>53</td>
<td>49</td>
<td>59</td>
<td>42</td>
<td>53</td>
</tr>
<tr>
<td>X47</td>
<td>Accidental poisoning by other gases &amp; vapours</td>
<td>34</td>
<td>25</td>
<td>24</td>
<td>26</td>
<td>25</td>
<td>16</td>
<td>17</td>
<td>16</td>
<td>23</td>
</tr>
</tbody>
</table>

- Occurrence at home: 29, 18, 16, 18, 24, 13, 11, 10, 17
- Occurrence in residential institution: 0, 0, 0, 0, 0, 0, 0, 0, 0
- Occurrence at school/other institution/pub/ admin area: 0, 0, 0, 0, 0, 0, 0, 0, 0
- Occurrence at sports/athletics area: 0, 0, 0, 0, 0, 0, 0, 0, 0
- Occurrence on street/highway: 1, 1, 0, 0, 0, 0, 0, 0, 3
- Occurrence at trade/service area: 1, 0, 0, 1, 0, 0, 0, 0, 0
- Occurrence at industrial/construction area: 0, 0, 1, 0, 1, 0, 0, 0, 0
- Occurrence on farm: 0, 0, 0, 0, 0, 0, 0, 0, 0
- Occurrence at other specified place: 3, 5, 6, 5, 1, 1, 4, 5, 1
- Occurrence at unspecified place: 0, 1, 1, 2, 0, 1, 2, 1, 2

**V01-V99 Transport accident**

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</tr>
</thead>
<tbody>
<tr>
<td>Accidental exposure to smoke, fire &amp; flames</td>
<td>45</td>
<td>40</td>
<td>36</td>
<td>29</td>
<td>27</td>
<td>32</td>
<td>40</td>
<td>26</td>
</tr>
</tbody>
</table>

Cause of death was defined using the International Classification of Diseases, Tenth Revision (ICD 10). Deaths were selected where the underlying cause of death was accidental (ICD 10 codes V01-X59) and where the secondary cause of death was the toxic effect of carbon monoxide (ICD 10 code T58).

Figures for England and Wales include deaths of non-residents.

Deaths registered in each calendar year.

*Source: Office for National Statistics*

### Table 2: Scotland - mortality figures 2012-2019

Carbon monoxide deaths (ICD 10 code: X47) data from the General Register Office for Scotland.

#### Mortality statistics for accidental CO poisoning in Scotland

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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Deaths by CO (X47)*</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

National Records of Scotland, Vital Events Reference Table 6.04

*X47 Other gases and Vapours (Carbon Monoxide)
Table 3: Northern Ireland - mortality figures 2012-2019

<table>
<thead>
<tr>
<th>Type of carbon monoxide death</th>
<th>ICD10 Code</th>
<th>Registration year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uncontrolled fire in a building or structure</td>
<td>X00</td>
<td>2</td>
</tr>
<tr>
<td>Exposure to controlled fire in a building or structure</td>
<td>X02</td>
<td>-</td>
</tr>
<tr>
<td>Exposure to ignition of highly flammable material</td>
<td>X04</td>
<td>-</td>
</tr>
<tr>
<td>Exposure to other specified smoke, fire &amp; flames</td>
<td>X08</td>
<td>-</td>
</tr>
<tr>
<td>Exposure to unspecified smoke, fire &amp; flames</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Accidental poisoning</td>
<td>X47</td>
<td>1</td>
</tr>
<tr>
<td>Intentional self-harm</td>
<td>X67, X76</td>
<td>5</td>
</tr>
<tr>
<td>Assault by smoke, fire &amp; flames (includes arson, cigarettes &amp; incendiary devices)</td>
<td>X97</td>
<td>-</td>
</tr>
<tr>
<td>Poisoning by and exposure to other gases &amp; vapours, undetermined intent</td>
<td>Y17</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>12</td>
</tr>
</tbody>
</table>

HSE – domestic gas

Since 1981 there has been a significant decrease in the number of CO fatalities related to domestic gas appliances, reported to HSE through RIDDOR (the Reporting of Injuries, Diseases and Dangerous Occurrence Regulations) – see Table 4.

This marked reduction in CO fatalities has been achieved by the entire gas system working together in partnership by:

- HSE overseeing delivery of the Gas Safe Register and the proactive gas inspections
- Manufacturers learning lessons and improving the safety of appliances
- The public acting on the messages such as use of CO alarms and regular servicing of appliances.

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3 Deaths from carbon monoxide poisoning have been defined using ICD10 code T58 and where carbon monoxide was mentioned on the death certificate.
Table 4: RIDGAS 1 Flammable gas incidents resulting in injury reported in Great Britain 2014/15 – 2019/20

<table>
<thead>
<tr>
<th>Type of incident</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of incidents</td>
<td>161</td>
</tr>
<tr>
<td>Carbon monoxide poisoning</td>
<td>138</td>
</tr>
<tr>
<td>Other exposure, eg to unburnt gas</td>
<td>6</td>
</tr>
<tr>
<td>Explosion/Fire</td>
<td>26</td>
</tr>
<tr>
<td>Total number of fatalities</td>
<td>6</td>
</tr>
<tr>
<td>Carbon monoxide poisoning</td>
<td>6</td>
</tr>
<tr>
<td>Other exposure, eg to unburnt gas</td>
<td>-</td>
</tr>
<tr>
<td>Explosion/Fire</td>
<td>-</td>
</tr>
<tr>
<td>Total number of non-fatalities</td>
<td>240</td>
</tr>
<tr>
<td>Carbon monoxide poisoning</td>
<td>214</td>
</tr>
<tr>
<td>Other exposure, eg to unburnt gas</td>
<td>3</td>
</tr>
<tr>
<td>Explosion/Fire</td>
<td>23</td>
</tr>
</tbody>
</table>

Source: Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR)
www.hse.gov.uk/statistics/tables/ridgas.xlsx

Key: (r) = revised data  (p) = provisional data

An incident can cause more than one fatality or injury

The table presents annual reported gas-related incidents that are notifiable under Regulation 11(1) of RIDDOR. This places a duty on certain conveyors of gas (including LPG), to notify HSE of an incident involving a fatal or major injury that has occurred as a result of the distribution or supply of flammable gas (mainly piped gas but also includes bottled LPG).

The statistics published are ‘as reported’ to HSE. When such reports are made, it is at the early stages of the incident, thus the detailed circumstances of the incident will not have been confirmed.

Key changes to the reporting system and the legal requirements for RIDDOR have occurred in recent years. More information on data changes affecting RIDDOR statistics is available at www.hse.gov.uk/statistics/riddor-notification.htm

- General information on domestic gas safety is available at www.hse.gov.uk/gas/domestic/index.htm.
- Statistics on HSE prosecutions by legislation (including the Gas Safety (Installation and Use) Regulations) are available on page 28 of this report and in ‘Table 3’ at www.hse.gov.uk/statistics/tables/prosecutions.xlsx.

MHCLG – English Housing Survey

The MHCLG English Housing Survey (EHS) 2019-20 shows that the number of homes having carbon monoxide alarms is increasing.

Based upon the results of sample surveys, the EHS estimates 44% of all dwellings had a carbon monoxide alarm in 2019. This is an increase from 42% in 2018 and 38% in 2017.

5. Raising CO awareness

The following section highlights some of the activities undertaken to raise awareness around CO safety during the reporting year (some planned activities were impacted by the COVID-19 pandemic).

Health & Safety Executive (HSE)/Health & Safety Executive Northern Ireland (HSENI) – Gas Safe Register

The aim of the Gas Safe Register (GSR)\(^4\) is to protect people from unsafe gas work. This is done partly through the inspection of gas work and investigation of reports of illegal gas work. GSR also works to protect people by raising levels of public awareness of the GSR brand, gas safety issues and the dangers of CO.

This includes awareness campaigns delivered via media, radio and television. As part of the ongoing Better Gas Safe Than Sorry campaign, GSR took to the streets of Birmingham in January 2020 to dispense bacon butties (and vegetarian alternatives) to shoppers at the Bullring, whilst sharing life-saving information on the dangers of CO.

The UK’s favourite breakfast hangover cure was a way of highlighting the similarity between the symptoms of a hangover and those of CO poisoning. The event was featured in the media and helped drive 30% more visits to the Gas Safe Register website than the same period the previous year.

Gas Safe Register’s TV ads have appeared regularly in 2020, starring dad Jack Corner, who would never cut corners when it comes to gas safety. The ads remind the nation that Gas Safe registered engineers are the only people who are qualified to carry out gas work in the UK’s homes.

\(^4\) The Gas Safe Register is operated on HSE/HSENI’s behalf by Capita Gas Registration and Ancillary Services
Other activity during the reporting period saw the 10th annual launch of Gas Safety Week$^5$ (GSW20), in September 2020. This year’s campaign focussed on the importance of communities and looking out for those around us who are vulnerable. This was particularly relevant during a year dominated by the COVID-19 pandemic. GSW20 called on communities to harness their new connectedness by sharing gas safety tips within their local networks.

The event included the release of ‘The Ripple Effect’ – a short animated film highlighting the devastating impact that an innocent gas safety slip in any one home can have on the wider neighbourhood. The Ripple Effect is available to watch on YouTube.

Analysis of the campaign indicates that GSW20 has already achieved some positive results with a 33.9 million reach via regional media.

GSR continues to engage with the industry through a number of forums and provides information to consumers and engineers through its website and contact centre, with the following statistics during the reporting period:

**Website:**
- Sessions: 4.28 million
- Page views: 24.5 million

**Social media:**
- GSR Twitter (verified account): 32,699 followers
- GSR Facebook (verified account): 42,553 followers
- LinkedIn: 16,767 followers
- Instagram: 12,054 followers
- YouTube: 790 subscribers and 506,910 video views

**HSE gas safety**

HSE provides a wide variety of information for consumers, gas engineers, and landlords on its domestic gas webpages at [www.hse.gov.uk/gas/domestic/index.htm](http://www.hse.gov.uk/gas/domestic/index.htm). From Autumn 2019-2020, HSE’s Domestic Gas webpages received over 141,500 views from visitors seeking advice through its Frequently Asked Questions section aimed at landlords, tenants and engineers.

HSE responded to around 150 direct enquiries from the public relating to gas safety and gas safety legislation, also, domestic gas ebulletins were issued to over 49,000 subscribers.

**Guidance on gas safety during COVID-19**

In response to the COVID-19 pandemic, HSE collaborated with GSR to provide guidance for registered gas engineers, landlords and tenants to enable annual gas safety checks to continue take place where possible and within Government guidelines during the pandemic. The

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$^5$ [www.gassaferegister.co.uk/gassafetyweek/about/](http://www.gassaferegister.co.uk/gassafetyweek/about/)
guidance included a variety of scenarios to provide specific advice which is available on both HSE and GSR’s websites at


The guidance aligns with MHCLG’s guidance to landlords and tenants (see page 17 of this Report) and Government guidance on working safely in peoples’ homes during the pandemic at: www.gov.uk/guidance/working-safely-during-coronavirus-covid-19/homes.

**HSENI – Carbon Monoxide Awareness Month**

November 2019 was the seventh year of the Northern Ireland Carbon Monoxide Awareness Month. HSENI continued to support CO awareness via social media with 3 posts promoting safety messages in relation to carbon monoxide. Other messages included reminding the public to get appliances properly installed, serviced and maintained, plus advice on landlord’s duties and for students.

- Total reach on Facebook: 1,000
- Total impressions on Twitter: 7,356

An advert on CO was also placed in the Ulster Tatler Caravan Club Handbook 2020.

**HSENI gas safety**

HSENI supported Gas Safety Week via social media with 10 posts. The messages promoting gas safety included:

- checking engineers are on the Gas Safe Register
- symptoms of CO poisoning
- what to do in an emergency, CO alarms and installing; and
- maintaining appliances

- Total reach on Facebook: 10,242
- Total impressions on Twitter: 20,000

With regards to the HSENI website, there were over 700 downloads of the carbon monoxide and gas safety publications during 2019/20. ‘Carbon Monoxide Detectors’ – advice and information on the use of carbon monoxide detectors was the most popular page, with 148 downloads during the year at: www.hseni.gov.uk/sites/hseni.gov.uk/files/publications/carbon-monoxide-detectors

Additionally, over 7,300 gas safety printed publications were distributed throughout 2019/20.

**Ministry of Housing, Communities & Local Government (MHCLG)**

MHCLG continues to make available its guidance for private residential landlords and anyone interested in letting a property in the private rented sector.
The guide, How to Let, first published in June 2018 explains the responsibilities, legal requirement, and best practice for letting a property in the private rented sector. Its features include:

- the requirement to install CO detectors
- carrying out checks on the first day of any tenancy to ensure smoke and CO detectors are operational; and
- arranging annual gas safety checks


MHCLG – guidance for landlords and tenants during COVID-19

The purpose of the guidance is to support landlords and tenants in managing property maintenance issues. Tenants have a right to a decent, warm and safe place to live. Where safe to do so, it is in the best interests of both tenants and landlords to ensure that properties are well maintained, kept in good repair and free from hazards. Landlords can take steps to carry out repairs and safety inspections provided these are undertaken in line with public health advice and relevant COVID-19 legislation and restrictions.

Public Health England (PHE)/Department of Health & Social Care (DHSC)
Policy and communications activities undertaken during the reporting period included:

- Providing advice through the PHE Keep Warm, Keep Well leaflet at: www.assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/932952/keep_warm_keep_well_2020.pdf. The leaflet contains information for the public on CO safety, around ensuring gas appliances are properly serviced and installed by qualified gas engineers, installation of CO detectors potential risks from solid fuels and where to find registered engineers.
- Providing advice through the NHS Stay Well This Winter leaflet, which contains information and advice for the public on where to find registered engineers at: www.assets.nhs.uk/prod/documents/Stay_well_this_winter_-_large_print.pdf
- Maintaining the Cold Weather Plan, which includes CO messages and can be found at: www.gov.uk/government/publications/cold-weather-plan-cwp-for-england.
- Developing the Cold Weather communications toolkit for local authorities and the NHS, which includes messages about getting appliances checked before winter.

**Office of Gas and Electricity Markets (Ofgem) – funding for gas distribution network (GDN)**

Ofgem’s recently published RIIO-2⁶ price controls covering the period from April 2021 to March 2026 seeks to ensure energy consumers across GB get better value for money, better quality of service and environmentally sustainable outcomes from the networks supplying them.

In particular, Ofgem has focussed the innovation stimulus on improving services for consumers and includes a step change in funding and protections for consumers in vulnerable situations. This includes providing the GDN companies with a new allowance (totalling £60m) for this purpose, with encouragement to work with local partners and charities to maximise the benefits from the support offered.

The level of funding was doubled in response to better company proposals than those initially submitted and stakeholders’ feedback. The work scope was increased to cover the repair/replacement of faulty gas heating appliances, where appropriate, to ensure consumers who are most in need are assisted when, for example, a boiler is not safe to use causing a carbon monoxide (CO) related incident.

It is expected that this allowance will enable the GDNs to:

- kickstart a variety of exciting projects
- work with each other and local partners
- increase awareness and protections against the dangers of CO; and
- provide new products and information to support consumers in vulnerable situations.

There will also be an annual showcase event which will be mandatory for GDNs to attend. They will be expected to present their work, summarising their progress and outcomes, what they have done to improve CO safety and awareness and how fuel-poor households may have benefitted.

For the gas distribution sector, Ofgem has also approved a RIIO-2 National Innovation Allowance (NIA) totalling £93 million and its purpose includes innovation relating to support for consumers in vulnerable situations.

A general overview may be found at: [www.ofgem.gov.uk/system/files/docs/2020/12/riio2_overview_document_web_1.pdf](http://www.ofgem.gov.uk/system/files/docs/2020/12/riio2_overview_document_web_1.pdf)

For further detail visit:

- [www.ofgem.gov.uk/system/files/docs/2021/02/final_determinations_-_core_document_revised.pdf](http://www.ofgem.gov.uk/system/files/docs/2021/02/final_determinations_-_core_document_revised.pdf) and

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⁶ RIIO: Revenue = Incentives + Innovation + Outputs
The Welsh Government
The gov.wales website continues to publish the following documents on the subject of CO and is available both in English and Welsh:


There is also a cross-reference link to the Welsh Government webpage on Schedule 1 of the Building Regulations about heat producing appliances which includes information on:

- CO alarms

Public Health Wales (PHW)
PHW continues to publish comprehensive information on their website to remind health professionals about reporting CO related incidents, along with general information for the public and professionals on the dangers of CO, the signs and symptoms and steps to take to avoid CO poisoning at: [www.phw.nhs.wales/topics/carbon-monoxide/](http://www.phw.nhs.wales/topics/carbon-monoxide/). An algorithm to support medical/health professionals in identifying and managing suspected CO poisoning in their patients is also available at: [www.wales.nhs.uk/sitesplus/888/page/50368](http://www.wales.nhs.uk/sitesplus/888/page/50368).
6. Supporting professionals

Public Health England (PHE) - National Poisons Information Service (NPIS)

The National Poisons Information Service (a service commissioned by PHE on behalf of UK health departments) Annual Report 2019/2020 includes information on the epidemiology of CO poisoning in the UK. CO poisoning remains a major public health issue in the UK and as such cases of CO poisoning are routinely dealt with by the UK NPIS. Healthcare professionals can access their poisons information database: www.TOXBASE.org, or telephone the national telephone enquiry line: 0344 892 0111.

Since June 2015, NPIS has received funding from the Gas Safety Trust (GST) to analyse all TOXBASE accesses and telephone enquiries relating to CO exposure in the UK. Unintentional non-fire related CO exposures pose a serious public health challenge and, as such, were the primary focus of this study.

During the period 1 January 2019 to 31 December 2019, data was available for 757 patient-related CO exposures:

- Of these, 175 (23.1%) were male and 212 (28.0%) were female, with gender not specified for 370 (48.9%) patients.
- Exposures comprised 497 adults (13 years or older, 65.7%) and 160 children (12 years or younger, 21.1%). Age was not specified in 100 exposures (13.2%). Twenty-three exposures involved pregnant women (3.0%).
- When smoke or fire were excluded as the source of CO, the highest proportion of unintentional exposures were caused by:

<table>
<thead>
<tr>
<th>Source of CO Exposure</th>
<th>Number</th>
<th>Proportion</th>
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<tbody>
<tr>
<td>Domestic boiler issues</td>
<td>221</td>
<td>29.2%</td>
</tr>
<tr>
<td>Vehicle exhaust fumes</td>
<td>59</td>
<td>7.8%</td>
</tr>
<tr>
<td>Gas appliances (excluding boilers and cookers)</td>
<td>49</td>
<td>6.5%</td>
</tr>
<tr>
<td>Domestic wood/coal fire burners</td>
<td>49</td>
<td>6.5%</td>
</tr>
</tbody>
</table>

- These CO exposures were mostly of low severity, 562 cases, (74.2%), associated with no symptoms or mild symptoms only. Moderate severity was recorded in 52 (6.9%) cases and severe symptoms in 4 cases (0.5%). One fatality (0.1%) was reported to the NPIS during this period following exposure to a generator exhaust.
- Of the exposures in pregnant women, 9 patients remained asymptomatic and 13 had symptoms of minor severity. In 1 patient, the presence of symptoms was not reported.
- Activation of a CO alarm prompted the patients to seek medical attention in 171 (21.2%) cases.
- Symptoms were often non-specific, and a headache was most frequently reported. The most prominent effects reported after CO exposure were:
  - Central nervous system symptoms: 25.1%
  - Effects on gastrointestinal system: 13.1%
  - Respiratory effects: 3.7%
  - Cardiovascular effects: 3.0%
Further work includes a planned data linkage study with Scotia Gas Networks (SGN) and the electronic Data Research and Innovation Service (eDRIS), to assess the health outcome of patients where a confirmed CO leak was reported by a SGN gas engineer.


**PHE - Health Protection Directorate – Centre for Radiation, Chemicals & Environmental Hazards (CRCE)/Environmental Hazards and Emergencies Dept (EHE)**

**Cold related materials**

The cold weather plan for England, which is a cross governmental framework coordinated by PHE (Extreme Events and Health Protection Group), contains information and advice around CO safety – specifically at Level 0 (year-round planning). For example, the following are topics contained within actions for individuals:

- Servicing of all gas, solid fuel and oil appliances by registered engineers
- Checking chimney and flues for blockages
- Fitting audible CO alarms

**PHE flooding materials**

PHE’s contribution to the flooding and health chapter of the National Flood Emergency Framework for England contains lines on the dangers of using diesel or petrol-powered generators indoors to either pump flood water out of buildings or to dry the interior. This danger is also highlighted in Annex E of the Communications Guide at: www.assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/388997/pb14238-nfef-201412.pdf.

This aspect is repeated in the On-call duty doctor’s pack (internal PHE resource) and the web learning module on flooding, further supporting professionals.

**PHE Health Improvement Directorate, Alcohol, Drugs, Tobacco & Justice Division**

In addition to exposure to CO caused by the incomplete combustion of fuel appliances, people can also be exposed to CO through smoking.

The NHS Long Term Plan sets out plans to treat tobacco dependence. By 2023/24, all people admitted to hospital who smoke will be offered NHS funded tobacco treatment services. The model will be adapted for pregnant smokers to include a new smoke free pregnancy pathway that includes CO screening and focussed treatments.

A new universal smoking cessation offer will also be available as part of specialist mental health services for long-term users of specialist mental health, and in learning disability services. On the advice of PHE, this will include the option to switch to e-cigarettes while in inpatient settings.

A self-assessment tool is also available to help local healthcare systems review their current practice in relation to National Institute of Heath and Care Excellence (NICE) guidance. PHE and NHS England continue to work through regional and local networks to support ongoing improvements.
Increasing the number of women having a smoke free pregnancy

The Tobacco Control Plan for England, Maternity Transformation Programme and the Saving Babies Lives care bundle, all commit to improving system-wide action to identify and support pregnant women who smoke. CO screening, referral and support pathways for pregnant women and their partners to stop smoking are a key part of these programmes.

There is strong collaboration between PHE and NHS England, to support the implementation of NICE guidance on smoking in pregnancy (PH26).

Recommendation 1 in this guidance advises midwives to conduct a CO test with ALL pregnant women as part of the process for identifying those who smoke or are exposed from other sources. Those women with elevated levels should be referred via an opt-out system for specialist support to stop smoking, or further discussions initiated regarding potential exposure to CO if not from smoking.

Unfortunately, CO monitoring for pregnant women was suspended in all settings from March 2020 for 9 months due to the COVID-19 pandemic. PHE have been working closely with partners to be able to reintroduce this as soon as possible. Reintroduction will be supported by a suite of online resources and webinars to update staff on CO screening conversations.

Health Education England provides online resources for professionals which are delivered through the Electronic Learning for Health (e-LfH) platform. These include a suite of short films and education materials and support different learning needs to help enhance confidence and communication skills amongst maternity staff to raise the issue and have brief, meaningful during and after pregnancy, often within the home and involving partners and other conversations about smoking with pregnant women and their partners.

The online resources have been increased this year to reach a wider audience of health visitors. Training on CO screening household members, supports staff to deliver ongoing conversations, ensuring smoke free homes and preventing CO poisoning.

The NICE and PHE guidance and self-assessment tools are available at:

- [www.nice.org.uk/guidance/ph26](http://www.nice.org.uk/guidance/ph26)
The on-line training and resources can be viewed at:
- www.e-lfh.org.uk/programmes/smoking-in-pregnancy/
- www.ilearn.rcm.org.uk/enrol/index.php?id=259
- www.rcm.org.uk/login/

**Smoking in Pregnancy Challenge Group resources**

The Smoking in Pregnancy Challenge Group has increased their range of tools, resources, and publications to inform women and partners of the risks of smoking in pregnancy, promoting a smoke free home and preventing CO exposure. The most widely used is the “test your breath” postcard, that informs pregnant women about the risks of CO, and the CO test, which is now available in ten different languages.

Maternity services can order these directly and, in some areas, the postcards are being included in booking packs.

There are also tools for professionals, including recommendations for local and national action plans and training guides.

New resources for Health Visitors include postcards to support conversations with pregnant women and families on the harms of second-hand smoke, supporting women to stay smoke free following birth and protecting future pregnancies through relapse prevention.

The Smokefree Action resources are all available at: www.smokefreeaction.org.uk/smokefree-nhs/smoking-in-pregnancy-challenge-group/.
7. Legislation and securing justice

HSE – enforcement activities
HSE/HSENi continue to work to secure justice and provide consumer protection where gas incidents are highlighted. This may be through the issue of an enforcement notice or prosecution in the event of a breach of the law.

During 2019/20, HSE issued 155 (provisional) enforcement notices in relation to breaches of the Gas Safety (Installation and Use) regulations 2018 (GSIUR) (fifth edition) including:

Further information can be found on HSE’s website at www.resources.hse.gov.uk/notices/.

HSE Prosecutions
During 2019/20 (provisional), HSE brought gas safety prosecutions under the Gas Safety (Installation & Use) Regulations 1998 (GSIUR) and The Health and Safety at Work etc Act 1974 (HSWA), including:

- 29 prosecution cases, 28 defendants – resulting in the following sentences:
  - 19 custodial sentences (13 of which were suspended) ranging from 3 - 22 months.
  - 9 community service orders ranging from 120 - 250 hours.
  - 8 fines awarded ranging from £1,000 to £280,000.
  - 3 compensation orders ranging from £500 to £11,902.

Note: a prosecution case may have more than one charge, therefore the number of sentences given can exceed the number of prosecutions/defendants.
Further information can be found on HSE’s website including:

### HSE – Gas Safe Register (GSR): enforcement

GSR supports enforcement activity through incident investigation and operational support – undertaking visits with HSE, HSENI and local authorities. The field operations teams also complete inspections to identify unsafe gas work and assess engineers’ competence. The GSR will apply sanctions if necessary, including the suspension or removal of engineers from the registered list, attendance at mandatory attendance events (MAE), or being subject to a heightened inspection regime. During 2019/20 GSR enforcement activity included:

**Inspections total (Apr-Mar 2019/2020)**

- Reg 3 - qualification & supervision: 72
- Reg 4 - duty on employer: 1
- Reg 5 - materials & workmanship: 1
- Reg 6 - general safety precautions: 1
- Reg 8 - existing gas fittings: 3
- Reg 26 - gas appliances safety precautions: 11
- Reg 33 - testing of appliances: 6
- Reg 36 - duties of landlords: 4

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<tr>
<td>Operative only – 15</td>
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<tr>
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<tr>
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</table>
As at 31 March 2020
Total number of registered businesses - 75,706
Total number of registered engineers - 149,920

MHCLG – Proposals to extend Smoke and Carbon Monoxide Alarm Regulations

A large proportion of those responding to the Government’s Social Housing Green Paper said they want consistent safety standards, including requirements for smoke and carbon monoxide alarms, whether they rent privately or live in social housing.

On 17 November 2020 the Government published a consultation proposing to extend the Smoke and Carbon Monoxide Alarm Regulations (England) 2015 and the provisions in Building Regulations guidance for carbon monoxide alarms. The consultation published alongside the Government’s Social Housing White Paper seeks views on:

- Amending the Smoke and Carbon Monoxide Alarm (England) Regulations 2015 to require social landlords to ensure at least one smoke alarm is installed on each storey of the premises on which there is a room used wholly or partly as living accommodation
- Amending the Smoke and Carbon Monoxide Alarm (England) Regulations 2015 to require private and social landlords to install a carbon monoxide alarm in any room where a fixed combustion appliance of any fuel type is used for heating
- Amending the statutory guidance (Approved Document J) supporting Part J of the Building Regulations to require that carbon monoxide alarms are fitted alongside the installation of a fixed combustion appliance for heating of any fuel type in homes of any tenure

The consultation closed on 11 January 2021 and can be viewed at: https://www.gov.uk/government/consultations/domestic-smoke-and-carbon-monoxide-alarms

MHCLG - Enforcement of CO alarms

Part J of the Building Regulations (England) requires the safe installation of combustion appliances in all properties, new and existing, regardless of fuel used or tenure. The Building Regulations also require the fitting of CO alarms when solid fuel burning appliances are installed. Most combustion appliance installations are carried out by installers registered with Competent Person Schemes to allow individuals and enterprises to self-certify that their work complies with the Building Regulations.

All registered businesses have their competence assessed and monitored by the scheme operators. Scheme operators have to meet MHCLG conditions of authorisation including a requirement for the scheme operator to be accredited by the UK Accreditation Service (UKAS).

The Smoke and Carbon Monoxide Alarm Regulations 2015 require landlords in the private rented sector to have a smoke alarm on every storey of their rental property used as living accommodation; and a carbon monoxide alarm in any room used as living accommodation where solid fuel is used.

Local authorities are responsible for enforcing the Regulations and will issue a remedial notice requiring a landlord to fit and/or test the alarms within 28 days. If the landlord fails to comply with the notice, they must, if the occupier consents, arrange for the alarms to be fitted and/or tested and can also impose a fine on the landlord of up to £5,000.
8. Research

Public Health England

PHE - Health Protection Directorate – CRCE/ Toxicology Department

As part of the National Institute for Health Research (NIHR) Health Protection Research Units (HPRU), PHE scientists have been undertaking a study of foetal carboxyhaemoglobin (CO- fHb) levels in blood spot samples collected from neonates in the catchment area for the John Radcliffe Hospital, Oxford.

This feasibility study is now completed with a working method developed. Funding and ethics committee approval is required to utilise this method to investigate CO-fHb levels in the general population.

PHE together with Frimley Park, St George’s and Wexham Park Hospitals, and others, are undertaking a Gas Safety Trust (GST) funded study of incidence of elevated CO-Hb levels in patients attending three emergency departments.

The project will be used to:

- validate the COMA (Companions, Outside, Maintenance, Alarm) mnemonic during triage to identify those patients with symptoms indicative of CO poisoning that are likely to be exposed to CO
- test novel analytical methods for the quantitation of CO-Hb using GC/MS\(^7\) and high-resolution mass spectrometry; and
- investigate seasonal effects, undertake biomarker discovery work using lipidomics and metabolomics and use the elevated CO-Hb levels to trigger premises inspections by gas engineers who will measure ambient CO levels and assess appliances.

The 18-month project which began in December 2018 was extended until December 2020 due to the COVID-19 pandemic and publications will follow in due course.

PHE - Health Protection Directorate – CRCE/ Chemicals and Environmental Effects Department

The Environmental Epidemiology Group has continued to support two projects in 2019/20:

- A PhD project for study of CO exposure measurement error by a combination of analytical chemistry and epidemiology methods. This is a GST-funded collaboration of PHE with Brunel University and Toxicology Department at Lausanne Hospital, Switzerland on several aspects of CO measurement error

  Work undertaken in 2019 focused on a review of errors attributable to variation in sampling and choice of method for exposure assessment. The doctoral dissertation was completed in 2020, and a PhD awarded for this work. It is expected that a further publication will be submitted that could be relevant to the design of future epidemiology studies of CO exposure indoors

- A PhD project for modelling of CO uptake and elimination, with a researcher from Taipei supported by a scholarship from Taiwan government has produced some new results. This year the researcher continued to conduct collaborative work with:

  - the Department of Respiratory Medicine at the Royal Berkshire Hospital, to analyse their lung function data in terms of variation attributable to factors affecting CO uptake and elimination, such as age, gender, and smoking status; and

\(^7\) Gas chromatography mass spectrometry tests
University College Hospital - to analyse data from CO uptake and elimination in a group of students

These studies both used a method developed within this study for modelling CO uptake and elimination using Python software to improve the performance of the CO multi-compartment model and make it more widely applicable to several public health and clinical settings. The PhD project is on target to be completed in 2021.

New publication on Carbon Monoxide hospital admissions – published July 2020

Researchers in PHE’s Environment Epidemiology Group working with the HPRU researchers at Imperial College on the Health Impact of Environment Hazards (Theme 1) have published a paper on an updated analysis of the trends in hospital admissions occurring in England as a result of CO exposure.

Unintended non-fire related CO admissions between 2002-2016 were analysed to see the effects of age, gender, deprivation, rurality and ethnicity. A comparison between the rates in England and other countries was also undertaken. The paper showed clear social class gradients with the most deprived groups being at higher risk. Risk was higher in areas with larger percentage of Black, Asian and Minority Ethnic (BAME) populations and in rural areas more than urban.

This work provides evidence for the identification of vulnerable populations, which can inform prevention policies and more targeted interventions.

Circumstances of fatal CO poisonings: a survey of text from coroners’ narrative reports 1998 – 2018

Unintentional non-fire-related CO poisoning continues to cause morbidity and death in the UK and elsewhere. Narrative reports from coroners may contain information to help prevent CO-related fatalities. The aim of this work is to provide information on the circumstances of unintentional non-fire-related deaths, in England and Wales between 1998-2010.

Analysis of 20 years’ worth of coroners’ narrative reports conducted by PHE in collaboration with Office of National Statistics (ONS) is currently underway and being prepared in a peer reviewed journal to be published in due course.

National Institute of Health Research (NIHR) – Health Protection Research Units

A small research project funded through the NIHR Health Protection Research Units at King’s College London is currently underway. The project, led by Dr Giovanni Leonardi, is looking at the epidemiological assessment of low-level environmental exposures, including carbon monoxide. Further details when available will be reported in the 2020/21 Annual Report.

9. Parliamentary activity

Parliamentary Questions
Departmental responses to the Parliamentary Questions raised in relation to Carbon Monoxide can be found at: www.parliament.uk/business/publications/written-questions-answers-statements/written-questions-answers/.

Attendance at All Party Parliamentary Carbon Monoxide Group (APPCOG) meetings to encourage debate and action on issues relating to CO
PHE and Gas Safe Register representatives attended and contributed to all APPCOG meetings in 2019-20, including the Group’s Stakeholder Forum, Medical Sub-Group (COMed) and Research Sub-Group (Sci-tech) meetings. Further information can be found at: www.policyconnect.org.uk/appcog/.