For further information, please contact
Adrian McConnell, Manager, All Party
Parliamentary Gas Safety Group;
Vilhelm Oberg, Head of Sustainability,
Policy Connect.

All Party Parliamentary Gas Safety Group
Policy Connect
CAN Mezzanine
32-36 Loman Street
London SE1 0EH

020 7202 8582
appgsg@policyconnect.org.uk

www.policyconnect.org.uk/appgsg

Printed on recycled paper

Sponsored by

a policy connect activity

All-Party Parliamentary gassafety Group

A report by the All Party Parliamentary Gas Safety Group

PREVENTING CARBON MONOXIDE POISONING

CONTENTS

FOREWORD

Every year around 4,000 people are diagnosed by A&E departments as having been poisoned by carbon monoxide. But it is thought that the number of people who have been, and continue to be, affected by carbon monoxide poisoning is far greater because cases are being woefully under-reported. This is due to a lack of awareness and because of the difficulties in diagnosing carbon monoxide poisoning. Many people may be living with low-level poisoning, not knowing it is happening, and with their lives therefore at constant risk.

The All Party Parliamentary Gas Safety Group initiated a six month inquiry into how we can better detect and improve awareness of this problem. The inquiry heard a catalogue of awful stories relating to carbon monoxide, including people being poisoned by barbecues, shisha pipes, air conditioning and other less obvious sources. In one incident, a group of people were accidentally poisoned when ovens in the restaurant they lived above had been left on overnight without adequate ventilation.

Clearly, the best way to prevent death and injury is a well trained and appropriately equipped workforce, correctly installing and maintaining appliances, combined with a high level of awareness of the symptoms and dangers of carbon monoxide poisoning amongst both the general public and medical professionals. The question is, how do we achieve this?

After six months examining these challenges and speaking to industry experts, medical professionals, victims and engineers, we have highlighted 17 examples of things that can be done that would make a big difference. Even in this constrained economic climate, there are relatively small steps that could be taken by Government, by the fossil fuels industries and by individuals, which would have an enormous impact on saving lives.

A crude calculation, based upon the Department of Health's estimates and the Government's approximation of the value of preventing a fatality or injury, suggests that as much as £178m each year could be saved though reducing the incidence of carbon monoxide poisoning. However, it is important to remember that this is not primarily about saving money, but about saving lives and preventing injuries.

The original purpose of the inquiry was to examine low-level exposure to carbon monoxide. It became quickly apparent however that for the purposes of this report, we could not focus on low-level exposure without considering higher levels of exposure to carbon monoxide. This is because low-level exposure can be cumulative and may herald a lethal poisoning. With this in mind, we adopted a more holistic approach and considered carbon monoxide poisoning in its widest sense, but with particular emphasis on lower level exposure. The recommendations in this report are therefore relevant at all levels.

The findings of this report represent a real opportunity to tackle carbon monoxide poisoning through improved detection, increased awareness and better regulation to establish parity of safety standards across the fossil fuel energy industry. I hope that Government and others will adopt the recommendations resulting from this inquiry; they are far less expensive than the cost of lives lost and damaged each year by avoidable carbon monoxide poisoning.

I would like to thank everyone who generously contributed to this inquiry and the members of the steering group for their time and hard work. I would especially like to thank David Kidney from the Chartered Institute for Environment Health for kindly chairing the victims' charities evidence session. I am also grateful to the Energy Networks Association, Energy UK and the Gas Industry Safety Group for their sponsorship, and to Adrian McConnell for all of his work in organising the inquiry and compiling this report.

Baroness Finlay of Llandaff
Inquiry Chair
All Party Parliamentary Gas Safety Group

EXECUTIVE SUMMARY

Preventing carbon monoxide poisoning must become a key priority for government, the energy industry, the medical profession and other stakeholders. Despite the progress made in recent years, there is a consensus that a lack of awareness and under-reporting masks the true number of incidents and fatalities. Although the Department of Health reports as many as 4,000 people each year diagnosed with low-level carbon monoxide exposure, and a further 200 admittances to hospital with serious injuries, and 50 fatalities every year, it is thought that the true numbers may be considerably higher. In addition to the enormous human tragedy and suffering, the cost to society is significant: it has been estimated that preventing carbon monoxide poisoning could save the UK £178 million each year.

In order to avoid this unnecessary suffering and cost, there is an urgent need for measures to increase detection, raise awareness and improve regulation. All agencies with an interest in carbon monoxide have a critical role to play in carbon monoxide poisoning reduction.

The key challenges in reducing carbon monoxide poisoning are that carbon monoxide cannot be seen, smelled or tasted; it is difficult to diagnose as it mimics the symptoms of other common illnesses such as flu and headaches; little is known about the long-term effects of exposure at acute or chronic low levels; and responsibility for detection and prevention lies with a wide range of government departments, agencies and other organisations. As a result, this report proposes the better use of detection and diagnosis equipment, and suggests ways in which policymakers and industry can take action to prevent carbon monoxide poisoning. Opportunities for raising awareness are highlighted, as well as alongside the importance of using equipment to detect carbon monoxide. The report also considers the current regulatory regime of the fossil fuel industry to ensure that it reflects the latest technological developments. Taken together these measures would, if implemented, help the UK reduce the incidence of carbon monoxide poisoning.

Improving detection

Given that carbon monoxide cannot be seen or tasted and does not smell, the use of detection equipment is vital. Carbon monoxide is measured in two ways: in the atmosphere and in the blood. Part of the problem for any study of low-level carbon monoxide poisoning is that there is no accepted minimum level of exposure, although it is agreed that there is no ‘safe’ low level of exposure. Susceptibility to carbon monoxide can vary, with the very young and very old being most vulnerable; in those who survive exposure, the long term sequelae are poorly documented.

The use of carbon monoxide alarms

There are no verified figures for how many carbon monoxide alarms there are in UK homes, but it is believed that it could be as low as 12%, compared to 82% that have a smoke alarm. Carbon monoxide alarms are no substitute for being aware of the dangers of carbon monoxide or having appliances correctly installed and regularly serviced by a registered engineer. However, increasing the number of carbon monoxide alarms in homes is an effective way to prevent death and injury from carbon monoxide. This report highlights a number of opportunities to increase the number of households protected by carbon monoxide alarms by incentivising their purchase or though their inclusion as a requirement of the Government’s energy saving initiatives.

Recommendation 1

The Government should remove VAT on all carbon monoxide alarms.

Recommendation 2

Mortgage providers and estate agents should include a declaration that the property has a carbon monoxide alarm and that appliances have been serviced by a Gas Safe registered engineer (or similarly registered for other fossil fuel appliances) within the last year.

Recommendation 3

The Government should ensure that all work under the Green Deal includes the installation of a carbon monoxide alarm and is carried out by a Gas Safe registered engineer (or similarly registered for other fossil fuel appliances).

Improving detection of carbon monoxide

Early detection of carbon monoxide is an essential part of diagnosis, prevention and treatment of poisoning. Access to appropriate equipment and training is the cornerstone to minimising injuries and fatalities. The inquiry heard that there is a significant lack of awareness and access to equipment amongst health care professionals and coroners. Furthermore, research into the effects and prevalence of carbon monoxide is urgently needed to improve diagnostic techniques and to ensure that resources are targeted where they are most needed. Doing so will not only improve identification of the presence of carbon monoxide, thus preventing injuries and fatalities, but will also help obtain a more accurate picture of the true number of people affected.

Recommendation 4

The Government should ensure that under the NHS contracts for services GPs' surgeries and A&E departments are trained to recognise the symptoms of carbon monoxide poisoning and have the ability to monitor for it, using the appropriate equipment whenever carbon monoxide exposure is suspected.

Recommendation 5

Industry should collaborate with the Medical Research Council and other research funding bodies to:

a) Support studies that attempt to evaluate the prevalence of carbon monoxide poisoning across different population groups.

b) Set up a longitudinal study to assess the sequelae of acute and low-level exposure to carbon monoxide poisoning.

c) Facilitate a study of the neurological effects of repeated exposure to carbon monoxide at low-levels.

Recommendation 6

The Government should trial GPs prescribing a Gas Safety Check for suspected carbon monoxide cases.

Recommendation 7

The Government should ensure that all coroners' post-mortems routinely test for carboxyhaemoglobin levels, recording death from carbon monoxide poisoning as a distinct category and to notify this to a central register if a verdict is recorded only in the narrative section of the coroner's certificate.

First Call Operatives

The key to improving detection amongst First Call Operatives is appropriate training and equipment. As Gas Emergency Service personnel, environmental health officers and paramedic first responders regularly enter potentially hazardous or even lethal environments as part of their job, their employers should provide the equipment to protect these staff and others. Gas Emergency Service personnel should have the appropriate tool to be able to detect the presence of carbon monoxide on entering any potentially dangerous environment. In addition, carbon monoxide detection equipment should also be available to paramedics. However, not only should they be issued with personal alarm monitors to detect atmospheric carbon monoxide in order to protect themselves, but given that carboyxhaemoglobin has a half life of four hours, all paramedics should be aware of the need for blood gases to be taken to check for raised carboxyhaemoglobin levels whenever it is suspected.

Recommendation 8

Gas Distribution Networks should ensure that all Gas Emergency Service personnel are equipped with either personal carbon monoxide alarms, carbon monoxide detection equipment, or both.

Recommendation 9

Ambulance Services should ensure that all their operatives have the equipment to monitor for carbon monoxide in the pre-hospital environment.

Raising awareness

The key to improving awareness of carbon monoxide poisoning amongst medical professionals, engineers and the general public is communication. Awareness amongst engineers is improving through competency-based training, and amongst clinical staff, particularly doctors and paramedics, due to the efforts of the Department of Health. However, there is a real need to raise awareness amongst the general public. The inquiry identified a number of missed opportunities to raise awareness, including through Personal, Social and Health Education in schools as well as Ofgem's gas suppliers' licensing conditions.

In addition, the inquiry heard concerns about a lack of joined up working between various industry organisations. Consequently, the report advocates an All Fuels Carbon Monoxide Forum to promote collaboration, share information and improve campaigning. The inquiry also discussed the issue of carbon monoxide poisoning caused by barbecue equipment. Given the number of incidents that took place this summer, it has recommended that the camping, caravanning and boating industries, together with barbecue and charcoal manufacturers, take urgent action to make sure that consumers are aware of the potential dangers in the misuse of barbecue equipment.

Recommendation 10

Retailers selling camping and barbecue equipment, registered campsites and caravan sites should promote the dangers of carbon monoxide and the use of carbon monoxide alarms. The British Standards Institute should revise European standard EN 1860 to include a requirement for a prominent warning about carbon monoxide poisoning as part of the information on appropriate usage.

Recommendation 11

The Government should include carbon monoxide in the home safety module of the Personal, Social and Health Education curriculum.

Recommendation 12

Ofgem should regularly review and evaluate the effectiveness of the requirement for gas retailers to raise awareness of carbon monoxide.

Recommendation 13

The Gas Safe Charity should support an All Fuels Carbon Monoxide Awareness Forum to coordinate cross industry campaigns, share knowledge and to strengthen links.

Better regulation

Given the Government's review of health and safety in the workplace, this report recommends that where fossil fuels are used in the home, safety considerations should outweigh any commitment to deregulation because of the dual risks of fire and carbon monoxide poisoning. Many respondents felt that regulation safeguarding consumers should be kept up-to-date to reflect technological and cultural developments. Consequently the inquiry examined regulation germane to gas safety and identified the Gas Safety (Installation and Use) Regulations 1998 and Part J of the Building Regulations as being among those in need of updating.

Recommendation 14

The Government should update the Gas Safety (Installation and Use) Regulations 1998 to:

a) Make mandatory the use of flue gas analysers for installation, commissioning and maintenance, where specified by the manufacturers' instructions (and manufacturers should ensure that those instructions. are updated to reflect the latest British Standards).
b) Include a full service of all appliances according to manufacturers' instructions.
c) Require all rented properties to be fitted with an audible carbon monoxide alarm manufactured to the European standard EN 50921.

Recommendation 15

The Government should consider both the public asset message and the possibility that new appliances may breakdown when determining the requirement for a wired-in carbon monoxide alarm in Part J of the Building Regulations.

Fossil fuel industry

Although there is a requirement for a wired-in smoke alarm to be fitted in all new-build homes and a carbon monoxide alarm where there is a solid fuel appliance, the solid fuel and oil industries are otherwise relatively unregulated in comparison to the gas industry. Whilst both the oil and solid fuel industries have registration schemes for competent engineers, there is no mandatory scheme to ensure that work is carried out by a qualified and competent professional. Such a scheme would improve reporting and recording of data relating to suspected incidents of carbon monoxide poisoning and would help to ensure that work is carried out by appropriately skilled engineers.

Recommendation 16

The Government should bring regulation for the whole fossil fuel sector in line with that of the gas industry.

Reporting incidents

The reporting of suspected carbon monoxide incidents is fragmented and disparate. Government agencies, departments and other organisations collect different types of data for a variety of reasons. The only way that it will be possible to develop a more complete picture of the situation in the UK is if this data is drawn together. This report therefore recommends a central collation point for data relating to carbon monoxide incidents. This would collect data in the same way as RIDDOR (Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995), therefore it is logical that the Health and Safety Executive, in conjunction with key industry organisations, should administer this initiative. It also advocates the setting up of a dedicated carbon monoxide helpline to act as a one stop shop for information. This would follow the model of NHS Direct and act as a signposting service that would run through the Gas Emergency helpline number, providing a tiered system to direct callers to the appropriate service.

Recommendation 17

The Health and Safety Executive, working in partnership with industry, should create a central collation point for data relating to carbon monoxide injuries and fatalities, together with a dedicated helpline that would help act as a signposting service.

METHODOLOGY AND STEERING GROUP

The All Party Parliamentary Gas Safety Group carried out a parliamentary inquiry into low-level exposure to carbon monoxide (CO) between May and July 2011. Five formal sessions were held in parliament, bringing together a range of industry representatives, policy makers and other key stakeholders. An additional session took evidence from charities representing victims of CO poisoning.

The inquiry was chaired by Baroness Finlay of Llandaff. The formal sessions were complemented by follow-up interviews with key stakeholders, the submission of written evidence and desk-based research. A steering group of senior industry representatives supported the inquiry and helped inform its direction.

The findings and policy recommendations in this report are based on the witness statements heard in the inquiry sessions, in-depth interviews and written submissions but do not necessarily reflect the opinions of individual witnesses, participants or steering group members.

Please see below for details of the members of the Steering Group, and the inquiry witnesses and contributors.

Steering Group

Chris Bielby	Chairman, Gas Industry Safety Group
Dr Simon Clarke	Consultant, Frimley Park Hospital
Vikki Courtman	CO Angels
Paul Everall CBE	Chief Executive, Local Authority Building Control
Andrew Humber	Team Leader, London Ambulance Service
Peter Jenkins	Head of Communications and Public Affairs, Energy UK
Ian Moss	Gas Safe Register Manager, EU Skills
Isabella Myers	Toxicologist, Health Protection Agency
John O'Grady	Northern Gas Networks and Energy Networks Association
Mark Rolfe	Customer Services Director, Gas Safe Register
Barry Sheerman MP	Co-Chair, All Party Parliamentary Gas Safety Group

CONTRIBUTORS TO THE INQUIRY

Ian Aldridge	Engineering Policy Manager, National Grid
Bruce Allen	Chief Executive, HETAS
Steve Brown	Technical Advisor, Ofgem
Tony Brunton	Technical Advisor, CO Awareness
Robert Burgon	Chief Executive, SNIPEF
Dr Simon Clarke	Consultant, Frimley Park Hospital
Colin Connor	Head of Energy Unit, Health and Safety Executive
Dr Ben Croxford	Senior Lecturer, University College London
Nigel Dumbrell	Head of Charitable Operations, Gas Safety Trust
Gerry Exell	Scottish and Southern Energy
Gordon Gilmour	Home Services Manager, Scottish Power
Tony Green	Senior Gas Safety Advisor, E.ON
Leigh Greenham	Director, Council of Gas Detection and Environmental Monitoring
David Hadden	Commercial Manager, Scotia Gas Networks
Stephen Hadley	Technical Advisor, Consumer Safety International
Jeremy Hawksley	Director General, Oftec
Paul Holley	Scientific Policy Manager, Department of Health
Bob Kerr	Head of Safety Strategy and Compliance, British Gas
Angela Love	Trustee, Gas Safe Charity
Barry Matthews	Committee Member, OPGO
Gary Oakford	Station Manager, Merseyside Fire and Rescue Service
David Osman	Energy Services Policy Analyst, nPower
Paul Overton	Director, CO Gas Safety
Vincenzo Rampulla	Public Affairs Officer, National Landlord Association
Stacey Rodgers	President, Dominic Rodgers Trust
Dr Andy Shaw	Reader in Environmental and Sustainable Technology, Liverpool John Moores University
Lisa Thomson	Policy and Communications Manager, UKLPG
Stephanie Trotter	President, CO Gas Safety
Dr Ed Walker	Medical Advisor, CO Awareness
Kevin Wellman	Chief Executive, Chartered Institute of Plumbing and Heating Engineering

1 INTRODUCTION

Over 4,000 people are diagnosed with carbon monoxide poisoning in England and Wales every year, according to the latest figures published by the Department of Health[1]. In May 2011, the All Party Parliamentary Gas Safety Group launched an inquiry into low-level exposure to carbon monoxide. The inquiry looked at how to raise awareness of carbon monoxide, recognise its symptoms and how to prevent it.

1.1 What is carbon monoxide poisoning?

Carbon monoxide is produced when there is incomplete combustion, for example when fuels such as gas, oil, coal and wood do not burn properly. In the home this is most commonly caused by appliances and flues that have been incorrectly installed, not maintained or are poorly ventilated.

Carbon monoxide cannot be seen, smelled or tasted, but it can kill quickly and without warning. The victim simply becomes sleepy, comatose and then dies, sometimes within minutes and often with no warning symptoms. It has been known for many years that carbon monoxide reduces the oxygen transported by the circulating blood. However, recent studies suggest that carbon monoxide also acts as a cell poison which could explain why it can be rapidly fatal without causing symptoms associated with a lack of oxygen to the brain, such as breathlessness.

Consequently, people surviving carbon monoxide poisoning often have neurological damage and cognitive impairment that can mimic the symptoms of a stroke or some types of dementia. Furthermore, long-term low-level exposure can also have symptoms that are easily confused with chronic upper respiratory tract infection, asthma, non-specific headache, migraine, depression, angina, chronic fatigue syndrome and myalgia. These mean that the true cause – low-level carbon monoxide exposure – is often misdiagnosed. As a result, the true incidence of low-level exposure to carbon monoxide remains unknown.

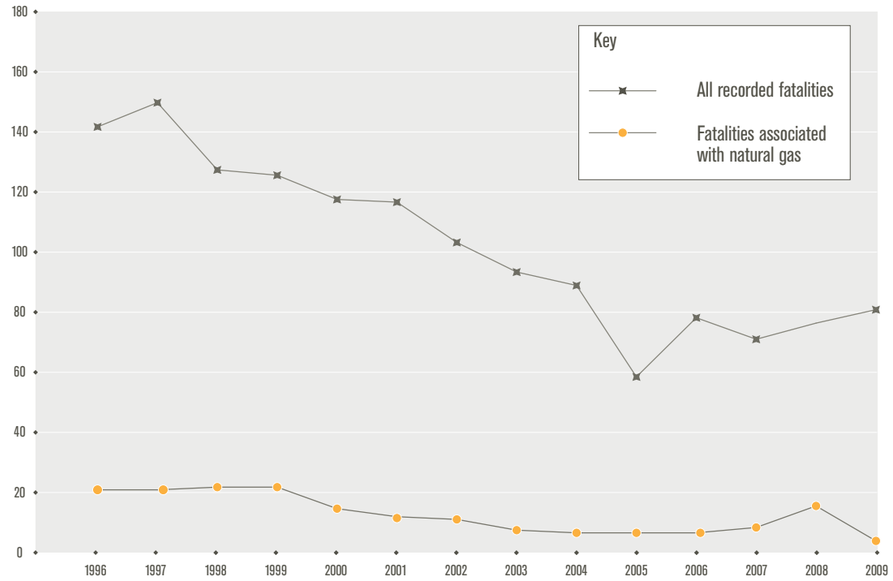
1.2 How common is carbon monoxide poisoning?

There is currently no single, agreed set of data regarding the number of injuries and fatalities caused by carbon monoxide poisoning. The inquiry heard that this is caused, in part, by the under-reporting of carbon monoxide poisoning.

The Office for National Statistics has collected data which show that the number of fatalities caused by accidental exposure to carbon monoxide in England and Wales decreased between 1995 and 2009[2]. These figures are based on information collected at death registration and include all fatalities from accidental carbon monoxide poisoning, not just those associated with a domestic fuel source. Furthermore, the Gas Safety Trust's Carbon Monoxide Trends report shows a similar trend for carbon monoxide related fatalities caused by natural gas (Figure 1)[3].

1 Department of Health, GP and Team Practice Bulletin, (19 September 2011) http://www.dh.gov.uk/en/Publicationsandstatistics/Bulletins/GPbulletin/index.htm
2 Hansard, Written Parliamentary Question, Column 491W (10 June 2011) http://www.publications.parliament.uk/pa/cm201011/cmhansrd/cm110610/text/110610w0001.htm
3 Gas Safety Trust, Carbon Monoxide Trends report 1996 to 2010 (September 2011)

Figure 1: Number of deaths caused by accidental exposure to the toxic effect of carbon monoxide (1996-2009)



In September 2011, the Department of Health published figures, based on Hospital Episode Statistics, which suggest that approximately 4,000 people attending A&E each year are diagnosed with carbon monoxide poisoning from a variety of sources. The Department has previously estimated that there are over 50 deaths and 200 serious injuries in England and Wales that require hospitalisation each year. These figures are based on incidents caused by carbon monoxide from a variety of sources.

However, it is thought that these figures underestimate the size of the problem due to lack of awareness and the difficulties in recognising the symptoms of carbon monoxide poisoning. The inquiry worked on the assumption that if unreported low-level exposure can be prevented, then the number of injuries and fatalities will fall accordingly.

The inquiry also heard that carboxyhaemoglobin levels in smokers are generally higher than in non-smokers, which has made it difficult to determine a level that could be deemed a diagnostic threshold[4].

4 Oral evidence from Dr Simon Clarke, Frimley Park Hospital (6 July 2011)

Figure 2: The Accident Triangle

The accident triangle, developed by H.W. Heinrich in the 1930s, has been a central theory of health and safety practice for almost 80 years. This theory states that there is a statistical relationship between unreported incidents, recorded near misses, and fatalities.

Heinrich suggested that for every death that occurs there are proportionally more recorded near misses and subsequently unreported incidents. In the case of carbon monoxide poisoning, this is supported by the recently published Department of Heath figures.

Heinrich argued that, rather than focus on the relatively small number of recorded deaths at the top of the triangle, to learn how to prevent fatalities and injury, we should focus on the more frequent accidents or near misses at the bottom or base of the triangle.

Although it is not possible to say with absolute certainty the ratio between fatalities attributable to carbon monoxide, and incidents leading to injury, the basic principle remains the same[5].

5 Figure 2 based on the accident triangle, taken from H.W. Heinrich, Industrial Accident Prevention (1931)

1.3 The value of preventing carbon monoxide poisoning

To estimate the value of saving a life or preventing an injury, the inquiry used the approach developed by the Department for Transport[6]. This takes into consideration 'pain, grief and suffering; lost economic output; medical and healthcare costs; material damage; police costs; insurance administration; and legal and court costs'[7]. The value placed on a prevented fatality is the result of extensive research and this methodology has been adopted across government[8]. Based on figures published in June 2009, the value of preventing a fatality is £1,585,510, whilst the value of preventing serious or minor injuries is £193,677 and £14,932 respectively, including the costs to the NHS[9].

Latest data published by the Department of Health in January 2011 show the average cost of a patient attending A&E as £95, whilst an emergency admission where the patient stays in for more than one day costs on average £1,360[10]. Similarly, the cost of an ambulance attending an incident where carbon monoxide is suspected costs on average between £223 and £254, depending on whether or not the situation is immediately life threatening[11].

This suggests that the cost of carbon monoxide poisoning is significant and that there would be a considerable benefit to be had by reducing injuries and fatalities. Based on the government's approximate figures, these incidents together could be costing the country as much as £177,738,900 annually[12].

6 Department for Transport, Valuation of Road Accidents and Casualties (2007)
http://webarchive.nationalarchives.gov.uk/+/http://www.dft.gov.uk/excel/173025/221412/221549/227755/2856721/article2costdatatables.xls
7 Department for Transport, The Accident Sub-Objective Unit 3.4.1 (April 2011)
http://www.dft.gov.uk/webtag/documents/expert/pdf/unit3.4.1.pdf
8 Health and Safety Executive, The Value of Beneifts of Health and Safety Control
http://www.hse.gov.uk/research/crr_pdf/2000/crr00273.pdf
9 Department for Transport, The Accident Sub-Objective Unit 3.4.1 (April 2011)
http://www.dft.gov.uk/webtag/documents/expert/pdf/unit3.4.1.pdf
10 Department of Health, NHS Reference Costs 2009 – 10 (January 2011)
http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_123459
11 Based on NHS Reference Costs 2009-10 (See above) PS08A and PS08B, Category A and Category B calls.
12 This figure is indicative, based on the latest available, estimated statistics. It was calculated as follows:
No. of CO incidents per annum (Department of Health) x Value of preventing an incident (Department of Transport)
Fatalities: 50 x £1,585,510 = £79,275,500
Serious Injury: 200 x £193,677 = £38,735,400
Minor Injury: 4,000 x £14,932 = £59,728,000
TOTAL: £177,738,900

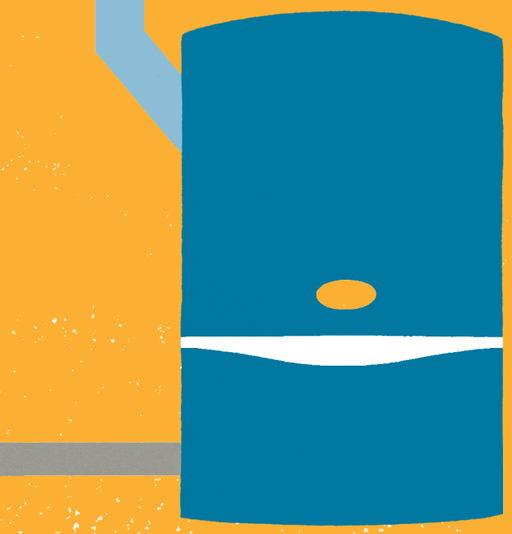
IAN FANNON

CASE STUDY

Ian was living in a rented house in Swindon with friends when they had a narrow escape from carbon monoxide poisoning. Ian and his girlfriend, as well as his housemate started to feel under the weather one winter, suffering from bad headaches.

Initially they put this down to the cold weather and assumed an infection was going around. One night Ian's headache got much worse and on his way to bed early, he was sick and passed out. When he regained consciousness, he managed to call NHS Direct and after a night in hospital, both he and his housemate, who had also suffered from the same symptoms, returned home and called out an engineer. The engineer confirmed that their boiler had been leaking carbon monoxide fumes into their living room. Ian experienced several frustrations after the incident in trying to hold his landlord to account.

He contacted the Health and Safety Executive, the environmental health department at his local council and Transco, and found that nobody would take responsibility for a) prosecuting the landlord (despite the landlord having no gas safety certificate and the fact that the boiler had not been serviced for 7 years) and b) ensuring the landlord's other properties were safe. In Ian's experience, he found that the issue did not seem to rest with any one organisation, so nobody was prepared to pursue it. Ian also tried the private prosecution route and sought free legal advice from a council-funded law service, but was told that because he was unable to prove he had suffered any permanent health damage, he had no case.



2 IMPROVING DETECTION

As carbon monoxide cannot be seen or tasted and does not smell, the use of equipment to aid detection is vital. This includes domestic audible carbon monoxide alarms manufactured to the European safety standard EN50291, appropriate equipment for use by first call operatives and engineers, and medical equipment such as pulse co-oximeters and blood gas analysers.

Carbon monoxide is measured in two ways: in the atmosphere and in the blood. However, the long-term outcomes of carbon monoxide exposure are unknown, while susceptibility to carbon monoxide can vary with the very young and very old being most vulnerable. As a result there is no accepted minimum level of exposure, which can hamper any study of low-level carbon monoxide poisoning.

The World Health Organisation has issued guidance for levels of carbon monoxide in the air, to prevent blood carboxyhaemoglobin (COHb) levels rising above 2.5% (Figure 3)[13].

Figure 3: WHO guidance on exposure to carbon monoxide[14]

Parts Per Million	mg m-3	Maximum period of exposure
87.1	100	15 minutes
52.3	60	30 minutes
26.1	30	1 hour
8.7	10	8 hours

A blood carboxyhaemoglobin level of 2.5% is the generally accepted threshold, above which, carboxyhaemoglobin appears to begin to have an adverse effect on peoples' health.

Carboxyhaemoglobin disappears from the body very quickly, which means that readings must be taken as soon as possible after exposure.

13 WHO Environmental Health Criteria 213: Carbon Monoxide, 2nd edition (1999)
14 Department of the Environment, Transport and the Regions Expert Panel on Air Quality Standards - Carbon Monoxide (1994)
http://webarchive.nationalarchives.gov.uk/20060715141954/
http://www.defra.gov.uk/environment/airquality/aqs/co/6.htm

Figure 4 : Health effects of COHb blood levels on healthy adults (BS EN 50291 – Table A1)[15]

% COHb	Effects
0.3 - 0.7	Normal range in non-smokers due to endogenous carbon monoxide production
0.7 - 2.9	No proven physiological changes
2.9 - 4.5	Cardiovascular changes in cardiac patients
4 - 6	Usual values observed in smokers, impairment in psychomotor tests
7 - 10	Cardiovascular changes in non-cardiac patients (increased cardiac output and coronary blood flow
10 - 20	Slight headache, weakness, potential burden on foetus
20 - 30	Severe headache, nausea, impairment in limb movements
30 - 40	Severe headache, irritability, confusion, impairment in visual acuity, nausea, muscular weakness, dizziness
40 - 50	Convulsions and unconsciousness
60 - 70	Coma, collapse, death

2.1 The use of carbon monoxide alarms

There are no verified figures for how many carbon monoxide alarms there are in UK homes, but it is believed that it could be as low as 12%. This is compared to 82% that have a smoke alarm[16]. Carbon monoxide alarms are not a substitute for being aware of the dangers of carbon monoxide or having appliances correctly installed and regularly serviced by a registered engineer. However, increasing the number of carbon monoxide alarms in homes is an effective way to prevent death and injury from carbon monoxide. Alarms should meet the European safety standard (EN50291)[17]. Carbon monoxide alarms should usually be installed in rooms in which gas, oil or solid fuel appliances are located, but it is important to check the manufacturers' instructions.

15 British Standard EN 50291 2001 - Electrical apparatus for the detection of carbon monoxide in domestic premises – Test methods and performance requirements, Table A1 (2001)
16 Oral evidence from Leigh Greenham, CoGDEM (1 June 2011)
17 British Standard EN 50291 2001 - Electrical apparatus for the detection of carbon monoxide in domestic premises (2001)

Buy Now, Pay Latte

The Council for Gas Detection and Environmental Monitoring say that the average cost of a carbon monoxide alarm is £20 and that an alarm, under normal conditions, will last up to seven years[18].

Based on this, a carbon monoxide alarm costs less than a cup of coffee for each year of its life.

2.2 VAT on carbon monoxide alarms

Due to the economic climate, many households are experiencing a reduction in their disposable income. A report published by the Institute for Fiscal Studies in March 2011 found that the income of the median UK household had fallen by 1.6% since 2008[19].

Against this financial backdrop, households have to make difficult decisions about how they spend their limited resources and the maintenance of heating and cooking appliances has become less of a priority. It is essential that households that have appliances fuelled by solid fuel, gas or oil, protect themselves with a carbon monoxide alarm so that faulty appliances are detected before they cause injury or fatalities.

The Government could promote sales of carbon monoxide alarms by making them VAT exempt, allowing retailers to sell them at a lower price. This would make alarms more affordable to lower income households. Furthermore, this would give retailers and manufacturers a strong promotional selling point which could be used to raise awareness of their use.

Recommendation 1

The Government should remove VAT on all carbon monoxide alarms.

18 Oral evidence from Leigh Greenham, CoGDEM (1 June 2011)
19 Institute for Fiscal Studies, Biggest three year fall in household incomes since early 1990s (21 March 2011) http://www.ifs.org.uk/pr/pr_210311.pdf

2.3 Mortgage providers and estate agents

The Gas Safety (Installation and Use) Regulations 1998 require landlords to arrange an annual safety check of all pipe work, appliances and flues provided for their tenants' use. However, no equivalent requirement exists for privately owned properties. The inquiry heard that many people feel that an 'Englishman's home is his castle' and that any legislation compelling homeowners to have their appliances annually serviced would be impractical, costly and difficult to enforce.

This laissez-faire approach has potentially serious consequences and the inquiry received a number of suggestions as to how safety could be improved in this area. For example, initiatives such as the smart metering programme and the Green Deal provide opportunities to install alarms and improve safety in privately owned homes.

Similarly, the inquiry heard how estate agents and mortgage providers also have a part to play. Estate agents and mortgage providers should include a declaration on relevant documentation, declaring that the appliances in a property have been serviced by an appropriately registered engineer in the previous year and that a carbon monoxide alarm(s) has been fitted. This should be made a condition of sale, which would provide an inexpensive and effective way to incentivise the use of carbon monoxide alarms and appropriate maintenance of appliances. In July 2011 the Land Registry reported that an average of 45,489 houses changed hands every month, between February and May 2011[20]. Based on these figures, over half a million houses are sold every year. Even taking into account those houses that are bought without requiring a mortgage or bought to let, this is a significant number of homes that could be made safer.

Recommendation 2

Mortgage providers and estate agents should include a declaration that the property has a carbon monoxide alarm and that appliances have been serviced by a Gas Safe registered engineer (or similarly registered for other fossil fuel appliances) within the last year.

2.4 The Green Deal opportunity

The Green Deal is a Government initiative to increase the energy efficiency of Great Britain's buildings. It will help homeowners finance energy saving measures such as installing insulation and energy efficient appliances. However, an unintended consequence of increasing a property's energy efficiency is that it can lead to reduced ventilation. If a faulty heating or cooking appliance is present in that property, there is a greater risk of carbon monoxide poisoning.

In June 2011, the All Party Parliamentary Gas Safety Group met with the Department for Energy and Climate Change to argue the case for including carbon monoxide alarms as part of the Green Deal. As a result, the Green Deal, which is an opportunity to install

20 Land Registry, House Price Index (August 2011)
http://www1.landregistry.gov.uk/upload/documents/HPI_report_Jul_11_ld2nw3.pdf

alarms in as many as 27 million homes, will require installers to assess the impact of their work on the air tightness of the property. If there is an increased risk of carbon monoxide poisoning as a result of their work, they will be required to fit a carbon monoxide alarm[21].

Given the relatively low cost of fitting a carbon monoxide alarm in comparison to the total cost of the energy efficiency improvements, Government should go further and make the installation of a carbon monoxide alarm, where one is not already present, a requirement under the Green Deal installer standard.

Recommendation 3

The Government should ensure that all work under the Green Deal includes the installation of a carbon monoxide alarm and is carried out by a Gas Safe registered engineer (or similarly registered for other fossil fuel appliances).

2.5 Improving detection of carbon monoxide amongst medical professionals

Carbon monoxide is often referred to as 'the silent killer'. It is often forgotten that it does not only kill but can incapacitate and have a devastating effect on peoples' lives. Recognising the effects of carbon monoxide poisoning quickly is essential as at high levels it can kill within minutes. Symptoms are wide ranging, inconsistent and vary on a case by case basis. The World Health Organisation identifies common symptoms as:

> *'Headache, lethargy/fatigue, nausea, dizziness and confusion. A victim may also suffer from shortness of breath, cardiac palpitations, convulsion, and paralysis, loss of consciousness, coma and eventually death'* [22]

Amongst medical professionals, increased awareness of the risks of low-level exposure to carbon monoxide will help identify those people who are being poisoned on a daily basis and may not even know it is happening.

21 Letter from Gregory Barker MP, Minister for the Green Deal (June 2011)
http://www.policyconnect.org.uk/appgsg/links/co-alarms-and-green-deal
22 WHO guidelines for indoor air quality: selected pollutants (2009)
http://www.euro.who.int/__data/assets/pdf_file/0009/128169/e94535.pdf

How carbon monoxide poisoning 'works'

In order to understand how carbon monoxide poisons the body it is important to understand how the body uses oxygen.

Oxygen is carried round the body by red blood cells. More precisely, oxygen binds to a protein in red blood cells known as haemoglobin. When we inhale, haemoglobin binds with oxygen as our blood passes through our lungs.

When oxygen binds with haemoglobin it forms a compound called oxyhaemoglobin. It is this 'oxygenated' blood which is carried through the bloodstream to where it is needed in our body. When we breathe in carbon monoxide it enters the bloodstream in the same way and quickly binds to haemoglobin to form carboxyhaemoglobin (COHb).

Carbon monoxide binds to haemoglobin at the same speed as oxygen, but its bond to haemoglobin is 245 times stronger. This means that carbon monoxide and oxygen compete on a level playing field for haemoglobin to bond with, but that the bond between oxygen and haemoglobin is much more easily broken. Consequently COHb increases with continual exposure, leaving less haemoglobin to carry oxygen round the body. Carbon monoxide also reduces the release of oxygen into the tissues of the body.

This can result in headaches, fatigue, nausea, dizziness and confusion. At higher levels it can cause shortness of breath, cardiac palpitations, convulsion, paralysis, loss of consciousness, coma and even death.

In January 2009, the All Party Parliamentary Gas Safety Group published a report, Raising Medical Professionals' Awareness of Carbon Monoxide Poisoning. The report called for a study to be carried out in A&E departments to determine the extent that carbon monoxide poisoning at low-levels is taking place. As a result, this year, Dr Simon Clarke, an Emergency Physician at Frimley Park Hospital in Surrey and a member of the inquiry's steering group, recently completed an observational study on behalf of the Health Protection Agency, which targeted patients with a predetermined set of symptoms and looked at a total of 1,758 people[23].

The All Party Parliamentary Gas Safety Group report also proposed the development of a diagnostic flowchart for use by GPs that includes the signs and symptoms of carbon monoxide[24]. Subsequently, the Health Protection Agency has produced an algorithm (see appendix 1) which complements the joint Chief Medical Officer's and Chief Nursing Officer's letter circulated to medical professionals by the Department of Health in November 2010[25,26].

The inquiry heard from Dr Ed Walker, a Consultant at Dewsbury and District Hospital and Medical Advisor to CO Awareness, who stressed the importance of appropriate

23 Oral Evidence from Dr Simon Clarke, Frimley Park Hospital (6 July 2011)
24 All Party Parliamentary Gas Safety Group report, Raising medical professionals' awareness of carbon monoxide poisoning (January 2009)
25 Health Protection Agency, Diagnosing Poisoning – Carbon Monoxide algorithm (November 2010) http://www.hpa.org.uk/web/HPAwebFile/HPAweb_C/1236845874045
26 Letter from Chief Medical Officer and Chief Nursing Officer regarding carbon monoxide (November 2010) http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_121501.pdf

training and access to suitable equipment for medical staff, to help diagnose carbon monoxide poisoning. Put very simply, in order to improve recognition of carbon monoxide poisoning, GPs and staff in A&E Departments should be trained to ask the following questions:

- Where are your symptoms worse? Are they bad at home and do they get better when you go out?
- Does anyone else at home have the same symptoms?

If there is any doubt, the patient should be tested for carbon monoxide poisoning and the medical professional should recommend that a registered Gas Safe engineer (or suitably qualified engineer where other fuels are used) check the appliances in the home[27]. This should be taught across the board, beyond A&E physicians with an interest in toxicology and paramedics who are members of a Hazardous Area Response Team, to every primary health care professional who is a first-responder in the community, including doctors, nurses and paramedics.

Low level exposure to carbon monoxide is often misdiagnosed as 'flu-like' symptoms, chronic fatigue or migraine. The inquiry was told by a number of respondents that the medical textbooks and guidance for medical staff should be updated to reflect the latest understanding of the symptoms of carbon monoxide poisoning. Likewise, to reinforce this message, carbon monoxide awareness should be included in core training and continuing professional development for all medical professionals. Furthermore, Dr Simon Clarke pointed out that the equipment used by GPs for smoking cessation can also be used (at no additional financial cost) where carbon monoxide is suspected[28].

Recommendation 4

The Government should ensure that under the NHS contracts for services GPs' surgeries and A&E departments are trained to recognise the symptoms of carbon monoxide poisoning and have the ability to monitor for it, using the appropriate equipment whenever carbon monoxide exposure is suspected.

The inquiry was told of a lack of information about the effects of low-level exposure to carbon monoxide, including the long-term neurological effects of carbon monoxide the health effects of repeat exposure at acute and low levels and its prevalence amongst different population groups.

Both Dr Clarke and Dr Walker stated that further studies are urgently needed to gain greater understanding of carbon monoxide, its effects on health and the mechanisms through which these effects are caused, so that treatments can be developed[29]. This is a view reiterated by the Gas Safety Trust, which funds medical research. Nigel Dumbrell, Head of Charitable Organisations at the Trust, made the point that a greater

27 Oral evidence from Dr Simon Clarke, Frimley Park Hospital (6 July 2011)
28 Ibid
29 Ibid (and oral evidence from Dr Ed Walker, CO Awareness (25 July 2011))

understanding of carbon monoxide will allow resources to be directed to where they are needed most[30].

Similarly, it was suggested to the inquiry that the NHS should commission a trial of GPs prescribing a gas appliance check where they suspect carbon monoxide poisoning. Isabella Myers, a Toxicologist at the Health Protection Agency suggested that the prescription should include a copy of the NHS *Carbon Monoxide: are you at risk?* leaflet[31], which contains advice and information about carbon monoxide, including details of how to get a gas safety check[32]. The trial should track the patient through the process and record the outcomes to develop and ensure a satisfactory patient pathway.

Recommendation 5

Industry should collaborate with the Medical Research Council and other research funding bodies to:

a) Support studies that attempt to evaluate the prevalence of carbon monoxide poisoning across different population groups.

b) Set up a longitudinal study to assess the sequelae of acute and low-level exposure to carbon monoxide poisoning.

c) Facilitate a study of the neurological effects of repeated exposure to carbon monoxide at low-levels.

Recommendation 6

The Government should trial GPs prescribing a Gas Safety Check for suspected carbon monoxide cases.

2.6 Improving detection of carbon monoxide amongst coroners

In France, around 400 deaths caused by carbon monoxide are recorded every year[33]. Although testing for carboxyhaemoglobin levels at post-mortem is not mandatory in France, the level of carboxyhaemoglobin in the blood is measured in every case where carbon monoxide poisoning is suspected. This is a higher figure than the number of deaths recorded in the UK and it is believed that this is due to under-reporting rather than the UK being safer.

The inquiry heard from CO Awareness, who are campaigning for change in this area, that the main indicator used by pathologists in the UK is that the victim has a pinkish hue or cherry red appearance[34]. Whilst it is true that some victims do have this distinctive skin colouration, its absence does not mean that carboxyhaemoglobin is not present. Consequently it is feared that many fatalities caused by carbon monoxide are being missed.

30 Oral evidence from Nigel Dumbrell, Gas Safety Trust (1 June 2011)
31 NHS, Carbon Monoxide: are you at risk? Leaflet (2008) http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_090124
32 Oral evidence from Isabella Myers, Health Protection Agency (16 September 2011)
33 Agnes Verrier, Institut de Veille Sanitaire, French carbon monoxide poisonings surveillance system (October 2010)
34 Oral evidence from Dr Ed Walker, CO Awareness (25 July 2011)

For example, in 2009, 1,379 deaths were recorded in England and Wales as having "ill defined or unknown causes of mortality"[35]. Given the difficulties in visually recognising the signs of carbon monoxide poisoning, it is likely that many fatalities are being attributed incorrectly to other respiratory or circulatory causes or recorded as "cause unknown". Therefore, the Government should routinely test all deaths for carbon monoxide poisoning at post-mortem. This would help to assess the extent to which carbon monoxide is an under-recognised factor, or is potentially contributing as a secondary factor in fatalities in the UK. The study to evaluate routine carbon monoxide testing at post-mortem should take place over the winter, when the use of heating appliances is at its highest.

Recommendation 7

The Government should ensure that all coroners' post-mortems routinely test for carboxyhaemoglobin levels, recording death from carbon monoxide poisoning as a distinct category and to notify this to a central register if a verdict is recorded only in the narrative section of the coroner's certificate.

2.7 Improving detection of carbon monoxide amongst First Call Operatives

The key to improving detection amongst Gas Emergency First Call Operatives is appropriate training and equipment. As Gas Emergency Service personnel, environmental health officers and paramedics regularly enter potentially hazardous or even lethal environments as part of their job, their employers should provide the equipment to protect themselves and others.

For Gas Emergency Service personnel, atmospheric carbon monoxide detection equipment is essential. For example, Scotia Gas Networks (see case study, page 28) have issued their operatives with personal alarm monitors, which are worn on the lapel. Other gas distribution networks are trialling the use of other types of equipment. Regardless of the equipment used, Gas Emergency Service personnel should have the appropriate tool to be able to detect the presence of carbon monoxide on entering a potentially dangerous environment.

Recommendation 8

Gas Distribution Networks should ensure that all Gas Emergency Service personnel are equipped with either personal carbon monoxide alarms, carbon monoxide detection equipment, or both.

35 These figures are based on the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (known as ICD 10) R95-R99 codes, which include Sudden Infant Death Syndrome and are taken from the Office for National Statistics - Mortality Statistics: Deaths registered in England and Wales (2009) http://www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcm%3A77-199137

SCOTIA GAS NETWORKS

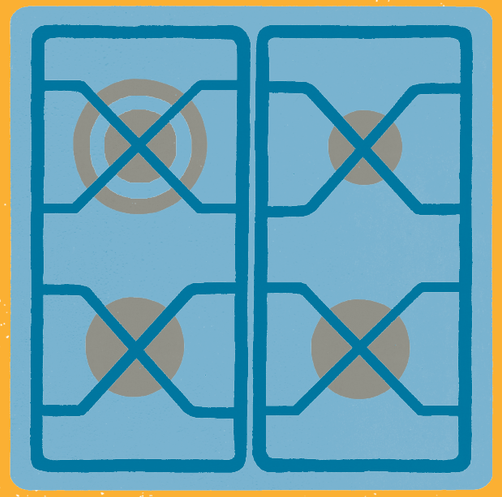
CASE STUDY

In 2006 Scotia Gas Networks reviewed its working practices for its operatives carrying out downstream emergency work. This is work that takes place on gas pipes and fittings, up to the gas meter. Scotia Gas Networks were concerned that emergency work on gas escapes inevitably exposes workers to gaseous atmospheres, including carbon monoxide. The review found that the use of gas instruments to test the atmosphere was only done periodically during work activities and that atmospheres can change quickly, often becoming hazardous without warning.

Safe working procedures to exit unsafe situations or wear breathing apparatus rely on knowledge that the atmosphere is unsafe. Scotia Gas Networks concluded that its maintenance operatives should be provided with personal atmosphere monitors with alarms set at pre-determined levels. As First Call Operatives are exposed to the risk from the leakage of carbon monoxide (especially as they attend reported emergencies of carbon monoxide leakage and work on gas apparatus in confined spaces), Scotia Gas Networks decided that they should also be issued with personal atmosphere monitors†.

Carbon monoxide safety in the home

These personal atmosphere monitors have activated whilst First Call Operatives were attending gas escapes and reports of carbon monoxide fumes on a number of occasions. When a carbon monoxide alarm activates in customers' premises the First Call Operative is required to investigate the cause and report it to Scotia Gas Networks' incident reporting team.



Between January 2009 and February 2011, there were 118 reports of personal atmosphere monitors activating in customer's premises due to the presence of carbon monoxide whilst First Call Operatives were undertaking both emergency work and non-emergency work††.

† The personal atmosphere monitors used by Scotia Gas Networks are set at 30ppm (Time Weighted Average for long term 8 hour exposure limit) and 200ppm (Short Term Exposure Limit – 15 minutes).

†† If a CO alarm activates in a premises the first call operative is required to investigate the cause in accordance with Scotia's procedure for attending reported carbon monoxide fumes to safeguard life and assess "Immediately Dangerous" and "At Risk" situations, or if applicable to apply a "Concern for Safety" notice. All CO alarm activations must also be reported to the Scotia's incident reporting team. Other than the immediate on site actions, consistent with attending a reported CO emergency, Scotia do not undertake post incident investigations.

Carbon monoxide detection equipment should also be available to paramedics, even in areas that have a Hazardous Area Response Team (HART). Paramedics should be issued with personal alarm monitors to detect atmospheric carbon monoxide in order to protect themselves. Personal carbon monoxide alarms should have the ability to record levels of carbon monoxide over time and all data collected by the Ambulance Service should be fed into the central recording system.

Moreover, given that carboyxhaemoglobin has a half life of four hours, all paramedics should be aware of the need for patients' blood gases to be checked for raised carboxyhaemoglobin levels whenever it is suspected (East Midland Ambulance Service Trust case study, page 30). The accuracy of pulse co-oximeters to check for raised carboxyhaemoglobin levels has yet to be proven as the sole screening tool.

A London Ambulance Service study in 2009, in which five ambulance crews were equipped with pulse co-oximeters, identified 83 cases of suspected carbon monoxide poisoning during the year long programme[36]. When compared to the Gas Safety Trust's Carbon Monoxide Trends report (which focuses on natural gas incidents) it is likely that rolled out nationally, the number of recorded incidents of suspected carbon monoxide poisoning would be much higher[37]. Incidents recorded during the study also demonstrated that ambulance personnel had on many occasions unwittingly been exposed to elevated carbon monoxide concentration, in which crews performed clinical assessment and treated patients.

Recommendation 9

Ambulance Services should ensure that all their operatives have the equipment to monitor for carbon monoxide in the pre-hospital environment.

36 Andrew Humber, A feasibility study into pre hospital carbon monoxide poisoning of patients (2009)
37 Gas Safety Trust, Carbon Monoxide Trends report 1996 to 2010 (September 2011)

EAST MIDLAND AMBULANCE SERVICE TRUST

CASE STUDY

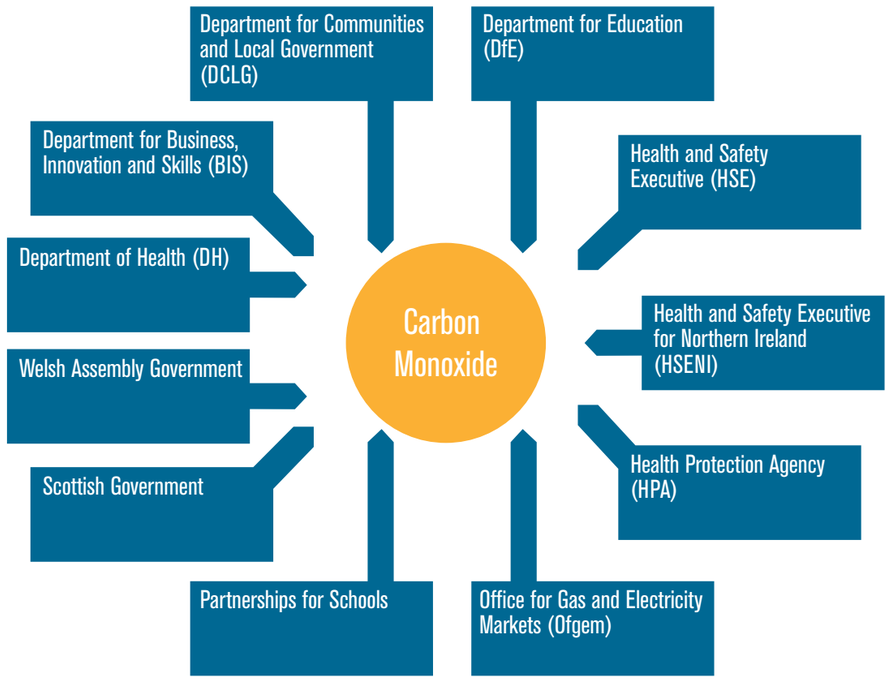
The East Midlands Ambulance Service Trust has given its staff the training and equipment to assess and diagnose carbon monoxide poisoning in the pre-hospital environment. The Trust enabled its one hundred Lifepak 15 defibrillators to monitor for carbon monoxide. Its lead has regrettably not been followed by most other Ambulance Service Trusts.

Dr John Stephenson, Clinical Director, NHS East Midlands said:

> "I was keen to introduce carbon monoxide monitoring into the ambulance service for two reasons: firstly to be able to assess which patients exposed to smoke in house fires required further treatment and assessment, therefore potentially decreasing hospital attendances and secondly the facility to detect elevated carbon monoxide levels in patients when you are not looking for it.
>
> I was aware of a few cases when we were later advised of the cause of illness being carbon monoxide poisoning and we had been unable to detect the problem and staff had been exposed in the house and potentially also affected.
>
> Carbon monoxide monitoring became available in an affordable package when we introduced the Lifepak 15 in 2009 and since then there have been many occasions when we have been aware that carbon monoxide may be an issue and been able to arrange appropriate care and advice".

3 RAISING AWARENESS

Figure 5: Government departments and agencies with a responsibility for carbon monoxide



The key to improving awareness of carbon monoxide poisoning amongst medical professionals, engineers and the general public is communication. The level of awareness of carbon monoxide poisoning ranges from ignorance, through to misconception, through to a minority who have a good understanding of its dangers. Though awareness amongst engineers is improving through competency based training, and amongst medics due to the efforts of the Department of Health, there is a real need to raise awareness amongst the general public.

Campaigns run by the Gas Safe Register and CO Be Alarmed are good examples of initiatives that are making inroads in this area, but there are other ways in which the message can be reinforced. One example is the trial currently being undertaken by Merseyside Fire and Rescue Service, who are including a test for carbon monoxide as part of their home fire safety checks (see case study, page 32).

MERSEYSIDE FIRE AND RESCUE SERVICE

CASE STUDY

Merseyside Fire and Rescue Service sees its role as promoting safer, healthier communities, with the service constantly evolving and responding to need as it arises.

The Service is piloting a project that monitors carbon monoxide levels in residential properties in the Liverpool area. The project involves carrying out background carbon monoxide checks in homes. This is part of the existing home fire safety checks that the service carries out in more than 100,000 homes annually. If the service finds unacceptable carbon monoxide levels, it assists the household immediately and signposts any other health and social needs to relevant agencies. The project is in its early stages but so far, more than 2,000 tests for carbon monoxide have been carried out and it has been expanded throughout Merseyside, which will lead to more than 100,000 tests for carbon monoxide per year.

This is part of a scheme that aims to reduce accidents in the home. Merseyside Fire Support Network works with the fire service to help deliver its safer, healthier community aims. The Network is delivering the Home Safety Equipment Scheme in partnership with Merseyside FRS, The Royal Society for the Prevention of Accidents (RoSPA) and all 26 children's centres in Liverpool.

The scheme is part of the Safe at Home: National Home Safety Equipment Scheme run by RoSPA. Safe at Home provides home safety equipment to the most disadvantaged families in areas with the highest accident rates. The children's centres refer families directly to the fire support network. This has dedicated employees and volunteers working within Liverpool communities to install different types of safety equipment for free. The scheme provides free home fire-safety checks, installing free smoke alarms, and taking carbon monoxide readings in every property.

Gary Oakford, a Station Manager at Merseyside Fire and Rescue, believes that information regarding carbon monoxide given by a fire officer in uniform is taken more seriously than other methods of delivering the message†. Although this study is ongoing, the credibility of the message through its delivery by a respected source is an important issue. If adopted by other uniformed services, this could prove an effective method of reaching those who otherwise may not be receptive.

† Oral evidence from Gary Oakford, Merseyside Fire and Rescue Service (29 July 2011)

In addition to these campaigns that generally raise awareness of the dangers of carbon monoxide, it is important that attention is drawn to specific causes for concern. One area highlighted by respondents was the misuse of gas appliances and other potential sources of carbon monoxide. Although it is not as common as injuries and fatalities caused by central heating systems, there have been a number of incidents where a cooker has been the source of carbon monoxide[38]. This has frequently been caused by distorted grill frets. There have also been a number of incidents where ovens or hobs were used as a heating source, leading to acute carbon monoxide poisoning. Even a well maintained cooker will produce carbon monoxide if it is kept on for extended periods of time with inadequate ventilation.

Residential properties above commercial premises

The inquiry heard of carbon monoxide incidents in flats above commercial premises, such as garages and restaurants, caused by inappropriate use of equipment and inadequate ventilation in the commercial part of the premises.

One example given was a group of people living in flats above a restaurant in Wandsworth who were treated for suspected carbon monoxide poisoning. Two residents who lived in the flat directly above the restaurant were found to have very high levels of carboxyhaemoglobin whilst a number of others were found to have been affected. There were no gas appliances in these flats so attention focused on the restaurant on the ground floor. A gas safety expert was called in to investigate and found the likely source of carbon monoxide to be a tandoor oven. The restaurant had recently opened and new cooking appliances, including the charcoal tandoor oven, had been installed at that time.

When the restaurant was open, the extraction system removed the carbon monoxide. However, at night, the extraction system was turned off, whilst the charcoal continued to burn. The smouldering embers produced much higher levels of carbon monoxide than when the tandoor was in use. The carbon monoxide levels subsequently built up in the kitchen and then rose up into the flats above. Given the limited guidance available, regarding the use of charcoal equipment inside premises, and that the equipment itself was found to be sound and properly manufactured, it was not possible to prove that the restaurant owners had knowingly breached health and safety legislation[39].

The above example highlights the need for environmental health departments and the Health and Safety Executive to raise awareness in the catering industry of the potential risks of leaving cooking equipment, such as gas burners and tandoor ovens on overnight without adequate ventilation. This should also include the potential risks of recreational charcoal use in these premises, such as shisha pipes[40].

38 Gas Safety Trust, Carbon Monoxide Trends report 1996 to 2010 (September 2011)
39 London Borough of Wandsworth, Health and Safety at Work Intervention Plan 2010/11 http://ww3.wandsworth.gov.uk/committ/mgConvert2PDF.aspx?ID=10886
40 Health Protection Agency, Chemical Hazards and Poisons report, Issue 19 (April 2011) www.hpa.org.uk/web/HPAwebFile/HPAweb_C/1296685843305

3.1 The risks of misusing barbecues and camping lamps

During the summer of 2011, there were a number of carbon monoxide incidents reported in the UK, caused by inappropriate use of barbecues, where lit barbecues were used in tents or under awnings[41]. Even when people are aware of the dangers of carbon monoxide, they are often associated with appliances in the home and people are unaware that barbecues can produce carbon monoxide. Consequently retailers selling barbecues, boating and camping equipment have a duty to warn customers of the dangers of carbon monoxide and should promote the use of carbon monoxide alarms at the point of sale. Likewise, registered caravan and campsites should include similar information in their welcome literature and onsite.

Charcoal available on the UK market today is generally packaged as a disposable barbecue or in strong paper bags that carry several pieces of information including the manufacturers' details, instructions for use and safety information, as required by European Standard EN 1860. The safety information usually includes a warning not to burn a barbecue indoors. However, most do not provide an explanation why not. People may believe that it is due to the risk of fire and may not be aware of the risk of carbon monoxide. Use of a clear, meaningful warning would help to draw the consumer's attention to the potential hazards.

It is the inquiry's view that this should be revisited and that in light of the incidents that have taken place this summer[42], the Standard should be revisited to ensure that specific information is included on packaging.

Recommendation 10

Retailers selling camping and barbecue equipment, registered campsites and caravan sites should promote the dangers of carbon monoxide and the use of carbon monoxide alarms; furthermore the British Standards Institute should revise European standard EN 1860, to include a requirement for a prominent warning about carbon monoxide poisoning as part of the information on appropriate usage.

3.2 Carbon monoxide awareness in schools

A prime opportunity for increasing awareness of carbon monoxide amongst the general public is through schools. The inquiry heard a number of views regarding how carbon monoxide and its dangers should be taught and where it fits into the national curriculum. The inquiry looked at ways the information could be delivered to children in an engaging way.

There are a number of initiatives organised by victims' charities, one example being CO Gas Safety's annual school poster competition[43]. Another is the Dominic Rodgers Trust

41 BBC News, Woman 'killed by barbecue fumes' in tent in Norfolk (6 July 2011)
http://www.bbc.co.uk/news/uk-england-norfolk-14051333
BBC News, Suspected carbon monoxide death at New Forest campsite (22 July 2011)
http://www.bbc.co.uk/news/uk-england-hampshire-14250243
BBC News, Crantock campers rescue five from carbon monoxide tent (30 August 2011)
http://www.bbc.co.uk/news/uk-england-cornwall-14713397

42 Ibid

43 CO Gas Safety Schools Poster Competition
http://www.co-gassafety.co.uk/competition.html

44 The Dominic Rodgers Trust was set up by Stacey Rodgers in 2004, after her 10-year-old son Dominic died of carbon monoxide poisoning from a neighbour's flue and faulty boiler.

which runs educational workshops for primary school children in Yorkshire[44]. The workshops run for thirty minutes and include interactive quizzes and demonstrations before a short test to see how much the children have understood about carbon monoxide. The Trust is currently producing a DVD which will be sent out to all secondary schools and used to promote awareness of carbon monoxide. This is an affordable and simple tool for teaching children about carbon monoxide and could easily be included in the Personal, Social and Health Education curriculum.

The inquiry concluded that the appropriate place for carbon monoxide to be taught is as part of the home safety module in Personal, Social and Health Education. In this way the information about the signs and dangers of carbon monoxide could be tailored appropriately to the child's age. Through personal, social and health education, topics are repeated and developed throughout a child's schooling, which reinforces and embeds the key messages.

Recommendation 11

The Government should include carbon monoxide in the home safety module of the Personal, Social and Health Education curriculum.

3.3 The role of Ofgem

Through the licence conditions, Ofgem places a number of obligations on gas retailers, including the Priority Service Register, which enables vulnerable or priority customers to access a free gas safety check. Ofgem's obligations also require retailers to regularly communicate to their customers the dangers of carbon monoxide.

Gas Suppliers' Licence: Standard Conditions
SLC 29 : Provision of gas safety information

29.4 The licensee must take all reasonable steps to provide, free of charge, the information required by paragraph 29.5 to each Domestic Customer at least once each year and must provide it when requested to do so by a Domestic Customer.

29.5 The information referred to in paragraph 29.4 is information sufficient to inform each of the licensee's Domestic Customers about:
(a) the safe use of gas appliances and other gas fittings;
(b) the dangers of carbon monoxide poisoning;
(c) the benefits of fitting an audible carbon monoxide alarm that complies with a relevant British or European safety standard;
(d) the benefits of gas safety checks; and
(e) where to seek advice if gas appliances are condemned as a result of a gas safety check.[45]

45 Ofgem, Standard conditions of gas supply licence
http://epr.ofgem.gov.uk/document_fetch.php?documentid=15667

A report published by Ofgem in June 2011 says that 2010 saw a 27% increase in the number of gas customers on the Priority Service Register[46]. This builds on similar increases during 2008 and 2009. However, other than the uptake of the Priority Service Register, and retailers reporting the number of leaflets that are sent out, Ofgem uses no quantitative measure of how effective these messages are.

Whilst acknowledging the efforts of retailers in publicising the Priority Service Register, and raising awareness through the Carbon Monoxide Be Alarmed campaign, Ofgem should look at how effective the leaflets are. Ofgem records how many leaflets are sent out, but does not seek to find out how many are read and how effective their message is. Steve Brown, Technical Advisor at Ofgem, told the inquiry that 'few, if any Gas Suppliers appear to undertake any proactive, direct monitoring of the efficiency of their Supply Licence Condition 29 messaging on gas safety. However some suppliers have confirmed that they have some means of assessing the effectiveness of their engagement with their customers on this issue, while some others are looking at introducing such initiatives'[47]. The inquiry considered ways in which this could be done. It was suggested that the leaflets should be sent out separately to bills and other literature. However, the inquiry recognised that there is no evidence that suggests that customers would be more likely to read the information than if it was received along with a bill. Alternatively, as many customers manage their energy bills online, retailers should ensure that information on carbon monoxide is prominently incorporated into the billing section of their websites. This would mean that customers checking their bill would see information relating to carbon monoxide, rather than the information being available on the website in a location where it has to be actively sought out. Another suggestion heard by the inquiry, was that as part of their promotional incentives, retailers could offer a free CO alarm to customers when switching supplier.

Recommendation 12

Ofgem should regularly review and evaluate the effectiveness of the requirement for gas retailers to raise awareness of carbon monoxide.

3.4 All Fuels Carbon Monoxide Awareness Forum

The inquiry heard that whilst across industry there are a range of activities aimed at preventing carbon monoxide poisoning, there was limited awareness of the different initiatives that are taking place. This is because these activities often take place in silos, resulting in limited knowledge outside that specific area.

In 2006, the All Party Parliamentary Gas Safety Group published a report into awareness of carbon monoxide poisoning in the UK calling for a similar forum for all organisations involved in preventing carbon monoxide poisoning[48]. The report highlighted the need for a single coordinating body to form a group with representatives from industry, government and charities, to work across all of the fuel types to co-ordinate campaigning on carbon monoxide.

46 Ofgem, Domestic suppliers' social obligations, 2010 annual report http://www.ofgem.gov.uk/Sustainability/SocAction/Monitoring/SoObMonitorDocuments1/Supplier%20Social%20Obligations%20annual%20report%202010.pdf
47 Written evidence from Steve Brown, Ofgem (29 September 2011)
48 All Party Parliamentary Gas Safety Group, Shouting about a silent killer: Raising carbon monoxide awareness (September 2006)

The Carbon Monoxide Consumer Awareness Alliance, commonly known as COCAA, was set up in response to this. The Alliance was made up of the major energy retailers and suppliers, representatives across all fuel types, victim support charities and representation from manufacturers of carbon monoxide alarms. It also worked closely with Ofgem, the Department of Health, the Department of Education and the Health & Safety Executive. Until November 2010, the secretariat was provided by the Gas Safety Trust. Since then, COCAA has not met.

The inquiry was repeatedly told that although coordination and cooperation between organisations has improved, the need for a unifying body is essential. Given the Gas Safety Charity's role in promoting awareness of carbon monoxide and other gas safety related issues, it should work with the industry to revive and reconvene this vital forum.

Recommendation 13

The Gas Safe Charity and other charities should support an All Fuels Carbon Monoxide Awareness Forum to coordinate cross industry campaigns, share knowledge and to strengthen links.

4 BETTER REGULATION

In March 2011, the Government launched a review of health and safety legislation in the workplace. The review is taking a one-in, one-out approach to regulation, designed to ensure that new regulation is only brought in when reductions can be made to existing regulation[49]. However, many submissions suggested that where fossil fuels are used in the home, safety considerations should outweigh any commitment to deregulation because the dual risks of fire and carbon monoxide poisoning are ever present. The inquiry received a number of suggestions regarding which regulations should be changed in order to reduce incidents of carbon monoxide poisoning. Many respondents felt that regulation safeguarding consumers should be kept up-to-date to reflect technological and cultural developments.

4.1 The Gas Safety (Installation and Use) Regulations 1998

The Gas Safety (Installation and Use) Regulations 1998 are one of the key pieces of legislation relating to carbon monoxide and the inquiry identified aspects of the regulations that should be revised. The regulations deal with the safe installation, maintenance and use of gas systems. They place responsibilities on a range of people including those fitting, servicing or repairing gas appliances as well as suppliers and users of gas, including landlords. The enforcing authority for the regulations is the Health and Safety Executive.

The Gas Safety (Installation and Use) Regulations 1998, under the heading Duties of employers and self-employed persons states that:

> *'It shall be the duty of every employer or self-employed person to ensure that any gas appliance, installation, pipe work or flue installed at any place of work under his control is maintained in a safe condition so as to prevent risk of injury to any person'*

The inquiry heard of the difficulties in visually inspecting an appliance for signs of carbon monoxide. Carbon monoxide can only be seen if there is sooting. However, if there is no sooting, it does not mean that an appliance is not leaking carbon monoxide. As a visual inspection of the flame picture is misleading, and the engineer is unable to see all of the burners in an appliance, the only way to test that complete combustion is taking place is through the use of appropriate flue gas analysis equipment.

From April 2012, Gas Safe registered engineers will be required to complete the Combustion Performance Analysis 1 (CPA1) assessment. The CPA1 will form part of the core assessment engineers sit every five years and will ensure that they are able to competently use flue gas analysers to assess correct and safe combustion.

In addition to this, there is a further carbon monoxide atmosphere and appliance testing assessment (CMDDA 1), which assesses a person's ability to investigate a

49 Health and Safety Executive, Common Sense, Common Safety (2011)
http://www.hse.gov.uk/aboutus/commonsense/index.htm

report of fumes and take atmosphere readings in order to establish the presence or production of carbon monoxide using portable electronic flue gas analysis equipment. Although it is optional, the fact that it exists, together with the introduction of CPA 1 into core assessments, should mean that Gas Safe registered engineers are competent and comfortable using this piece of equipment. However, it is essential that regulation keeps up with the development and increased availability of skills and technology that can improve gas safety and the detection of carbon monoxide.

In light of these developments, the Gas Safety (Installation and Use) Regulations 1998 should be amended to require the use of flue gas analysers where specified by the manufacturer's instructions. It is important to note that not all manufacturers include the use of flue gas analysers as part of their installation, commissioning and/or maintenance instructions. Manufacturers should update their instructions to include parameters for safe combustion performance readings as well as ensuring that they meet the latest British Standards[50].

A recent report by the Gas Safety Trust found that the risk of carbon monoxide poisoning occurring in privately owned rental properties to be 50% greater than in either an owner occupied property or one with a social sector landlord[51]. Landlords are required by law to have all gas appliances in a rented property checked by a Gas Safe registered engineer on an annual basis. All work and safety checks carried out by a Gas Safe engineer must comply with the Gas Safety (Installation and Use) Regulations 1998[52]. It is clear that although the introduction of a mandatory annual safety check is making some difference, further action is needed to bring the incidence rate down to levels comparable with other types of tenure such as owner-occupiers.

The Government should therefore revisit the landlord provisions within this regulation as part of the review of health and safety regulation and amend it to require that the person undertaking the check must undertake a full service of all appliances according to manufacturer's instructions. In addition to this, under the regulations, all landlords should be required to install an audible carbon monoxide detector, manufactured to European standard EN 50921 as a safety back up.

Recommendation 14

The Government should update the Gas Safety (Installation and Use) Regulations 1998 to:

a) Make mandatory the use of flue gas analysers for installation, commissioning and maintenance, where specified by the manufacturers' instructions (and manufacturers should ensure that those instructions are updated to reflect the latest British Standards).
b) Include a full service of all appliances according to manufacturers' instructions.
c) Require all rented properties to be fitted with an audible carbon monoxide alarm manufactured to the European standard EN 50921

50 British Standards
http://www.bsigroup.com/
51 Gas Safety Trust, Carbon Monoxide Trends report 1996 to 2010 (September 2011)
52 Health and Safety Executive, Landlords - A Guide to Landlords' Duties: Gas Safety (Installation and Use) Regulations 1998 (2009)
http://www.hse.gov.uk/pubns/indg285.pdf

4.2 Building Regulations (Part J)

Currently, building regulations require a wired-in smoke alarm to be fitted in all new-build homes and a carbon monoxide alarm to be fitted where there is a solid fuel appliance. However, there is no similar requirement for other fuel types. This is covered by the Building Regulations (Part J) which deals specifically with heat producing appliances[53]. Some respondents argued that the Government should go further and amend the Building Regulations to require a wired-in carbon monoxide alarm to be fitted in all new build homes regardless of the type of fuel used.

However, when the requirement was introduced for a carbon monoxide alarm in all new homes with a solid fuel appliance, the Department for Communities and Local Government carried out a cost benefit analysis of fitting wired in alarms in all new-build housing. The analysis found that it was not cost effective to install a CO detector with new gas and LPG appliances because these appliances have a secondary safety system built in[54]. However, the Government would send a clear signal if it requires all new homes to have a carbon monoxide alarm which may alter individual behavior. The Government will be consulting on future changes to the Building Regulations in December 2011. Given that it has agreed to include consideration of carbon monoxide in the Green Deal installer standard, which acknowledges the increased risks in homes with reduced ventilation, the Government should revisit this issue.

Recommendation 15

The Government should consider both the public asset message and the possibility that new appliances may breakdown, when determining the requirement for a wired-in carbon monoxide alarm.

4.3 Fossil fuel industry

Although there is a requirement for a wired-in smoke alarm to be fitted in all new-build homes and a carbon monoxide alarm where there is a solid fuel appliance, the solid fuel and oil industries are otherwise relatively unregulated in comparison to the gas industry.

Both industries point out that their respective fuels have what Bruce Allen, Chief Executive of the Heating Equipment Testing and Approval Scheme (HETAS), described as "almost a built in safety factor", noting that in the case of solid fuel, "it is lit using paper and stick which produce a lot of smoke, so that if the chimney or flue stops drawing, you tend to know about it". But this "built in safety factor" does not happen if smokeless fuel is used with firelighters. The most recent carbon monoxide fatalities related to solid fuels have been caused by a lack of maintenance, the use of poor quality fuels, or both. Both can lead to the flue becoming blocked. Mr Allen said that he believed that incidents caused by carbon monoxide were under-reported[55]. Jeremy Hawksley, Director General of the Oil Firing Technical Association (OFTEC), made a

53 Department for Communities and Local Government, Building Regulations (Part J): Combustion Appliances and Fuel Storage Systems (2002) http://www.planningportal.gov.uk/uploads/br/BR_PDF_ADJ_2002.pdf
54 Department for Communities and Local Government, Study on the Provision of Carbon Monoxide Detectors under the Building Regulations (2009) http://www.communities.gov.uk/documents/planningandbuilding/pdf/1324663
55 Oral evidence from Bruce Allen, HETAS (6 July 2011)

similar point with regards to oil fueled heating systems, stating that "the characteristics of oil combustion (which is different from gas combustion) mean that soot is created, and this typically causes the boiler to lock out and cease to operate"[56].

OFTEC and HETAS collect data on suspected carbon monoxide incidents and report them voluntarily through the Downstream Incident Data report. However there is nothing to compel people to report suspected incidents to either organisation, nor is there a requirement under RIDDOR (Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995) to report incidents caused by fuels other than gas to the Health and Safety Executive. Furthermore, whilst both organisations act as a registration scheme for competent engineers who work in their respective industries, there is no mandatory registration scheme for either industry to ensure that work is carried out by a qualified, competent professional. Such a scheme would improve reporting and recording of data relating to suspected incidents of carbon monoxide poisoning and would help to ensure that work is carried out by appropriately skilled engineers.

Recommendation 16

The Government should seek to bring regulation for the whole fossil fuel sector in line with that of the gas industry.

4.4 Reporting incidents

Reporting of suspected carbon monoxide incidents is fragmented and disparate. Government agencies, departments and other organisations collect different types of data for a variety of reasons. The only way that it will be possible to develop a more complete picture of the situation in the UK is if this data is drawn together.

The inquiry heard a number of ideas of how this could best be achieved. One suggestion was for a central collation point for data relating to carbon monoxide incidents. This would collect data in the same way as RIDDOR reporting and therefore it is logical that the Health and Safety Executive, who are responsible for RIDDOR, in conjunction with key industry organisations, should administer this initiative.

Furthermore, a number of the gas distribution networks expressed an interest in being involved in setting up a dedicated carbon monoxide helpline to act as a one stop shop for information. This should follow the model of NHS Direct and act as a signposting service that would run through the Gas Emergency helpline number, providing a tiered system to direct callers to the appropriate service.

56 Written evidence from Jeremy Hawksley, OFTEC (5 August 2011)

A carbon monoxide helpline would act as a way to capture data, but it could also:
- Act as an all fuels helpline, directing callers to the appropriate organisation.
- Direct callers to the correct supplier if their appliance has been condemned.
- Provide information about carbon monoxide and other gas safety related issues.
- Pick up carbon monoxide alarm false-alarms before they reach the gas emergency service (which would save considerable sums of money each year).

Recommendation 17

The Health and Safety Executive, working in partnership with industry, should create a central collation point for data relating to carbon monoxide injuries and fatalities, together with a dedicated helpline that would help act as a signposting service.

APPENDIX 1

HPA – Diagnosing CO algorithm:

Notes

Box 1: Carbon monoxide is a mimic Carbon monoxide poisoning is notorious for simulating other more common conditions, including fl u-like illnesses, migraine, food-poisoning, tension headaches and depression. Headache is the commonest symptom - think CO!

Box 2: Carbon monoxide sources are multiple The source of CO may be in the home, in the car due to a leaking exhaust system, or in the workplace. Gas, oil, coal, coke and wood heating appliances are the commonest sources in the home. Malfunctioning heating appliances may be indicated by there being yellow rather than blue flames (if it is not a 'decorative flame' fire) and by the deposition of soot on radiants or on the wall adjacent to the fire. There may be more than one source of carbon monoxide. Poisoning is not limited to those from lower income groups. Carbon monoxide can leak into a semidetached or terraced house/flat from neighbouring premises. It is unlikely that a patient will know about servicing of appliances at his/her workplace, but it is worth asking about the sort of heating devices in use. It is also worth asking: "Have you recently started to re-use heating appliances/boilers after the summer break/during an unexpected cold spell?"

Box 3: Stopping further exposure is essential Preventing further exposure is the most important thing you can do. Breath tests and blood samples may prove inconclusive some hours after exposure has ended: CO levels in the blood decline with a half-life of about 6 hours. Note that a normal concentration of carboxyhaemoglobin (COHb) does not disprove CO poisoning unless the sample has been taken soon after exposure ended. A heparinized venous blood sample should however, always be taken and sent to the local Clinical Chemistry Laboratory for analysis. For interpretation of results and detailed advice on CO poisoning see TOXBASE and call NPIS. If you strongly suspect CO poisoning do not wait for the result of the analysis before taking the other steps listed in Box 3. Contacting the gas (0800 111999), oil (0845 6585080) or solid fuel (0845 6014406) safety services is essential. Contacting your local HPU is essential as they will co-ordinate Environmental Health, Safety, Social and other services to protect your patient and others. Follow-up is important as further consequences of chronic exposure to CO may be delayed, or mild symptoms may persist, multiply or intensify. Recommend the purchase of an audible carbon monoxide alarm for installation in the home.

Box 4 Links and contact details for information on carbon monoxide
- TOXBASE: www.toxbase.org.
- National Poisons Information Service (NPIS) 24 h hotline: 0844 892 0111
- Health Protection Agency: www.hpa.org.uk/chemicals/compendium/carbon_monoxide/default.htm
- NHS Direct: www.nhsdirect.nhs.uk
- Department of Health: www.direct.gov.uk/keepwarmkeepwell
- Carbon monoxide – Are you at risk?: www.dh.gov.uk
- Information in joint CMO/CNO letter of November 2008: www.dh.gov.uk/cmo
- Local HPU contacts: www.hpa.org.uk/hpucontactdetails. 24 h Chemicals hotline: 0844 892 0555

GLOSSARY OF TERMS

This glossary of terms defines what is meant by some of the phrases used in the report.

A&E
Accident and Emergency department.

Building Regulations (Part J)
Part J of the Building Regulations sets out requirements for combustion appliances and fuel storage systems. This covers the construction, installation and use of boilers, chimneys, flues, hearths and fuel storage installations.

Carboxyhaemoglobin (COHb)
Carboxyhaemoglobin is formed when inhaled carbon monoxide combines with haemoglobin. Carboxyhaemoglobin binds more tightly than oxygen and rendering haemoglobin incapable of transporting oxygen to where it is needed in the body.

Fossil fuels
Fossil fuels are fuels containing carbon – coal, oil and gas – that were formed over millions of years through the decay, burial and compaction of rotting vegetation on land, and of marine organisms on the sea floor.

Gas Safe Register
Gas Safe Register is the official list of gas engineers who are registered to work safely and legally on gas appliances in the United Kingdom, Isle of Man and Guernsey.

Gas Safety (Installation and Use) Regulations 1998
The Regulations affect a wide range of people, from those installing, servicing, maintaining or repairing gas appliances and other gas fittings, to suppliers and users of gas, including some landlords.

Gas Suppliers' Licence
The Gas Suppliers' Licence places a number of obligations on gas retailers, including the Priority Service Register, which enables vulnerable or priority customers to access a free gas safety check. It also requires retailers to regularly communicate to their customers the dangers of carbon monoxide.

Green Deal
The Green Deal is a Government initiative to increase the energy efficiency of Britain's buildings. It will help homeowners finance energy saving measures such as installing insulation and energy efficient appliances.

Health and Safety Executive (HSE)
The Health and Safety Executive is responsible for the encouragement, regulation and enforcement of workplace health, safety and welfare, and for research into occupational risks in England and Wales and Scotland.

Health Protection Agency (HPA)
The Health Protection Agency provides an integrated approach to protecting UK public health through the provision of support and advice to the NHS, local authorities, emergency services, other arms length bodies, the Department of Health and the devolved administrations.

Hospital Episode Statistics
Hospital Episode Statistics are a data warehouse containing details of all admissions to NHS hospitals in England. In addition to NHS patients, it includes private patients treated in NHS hospitals, patients who were resident outside of England and care delivered by treatment centres (including those in the independent sector) funded by the NHS. It also contains details of all NHS outpatient appointments in England.

Office of Gas and Electricity Markets (Ofgem)
Ofgem is the regulator for the gas and electricity markets. It promotes competition, wherever appropriate, and regulates the Gas Distribution Networks (GDNs).

Priority Service Register
Energy suppliers are obliged to provide a range of free services to certain customers through the Priority Service Register (PSR). The PSR is available to anyone of pensionable age, living with a disability or chronic illness, or with a visual or hearing impairment. Joining the PSR entitles customers to a range of free services including a gas appliance and installation safety check.

Psychomotor test
A test that assesses a person's ability to perceive instructions and perform motor responses.

Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR)
A regulation covering the statutory obligation to report deaths, injuries, diseases and "dangerous occurrences" that take place at work or in connection with work. It also requires registered gas engineers to report poor and dangerous gas installations.

Sequelae
A pathological condition resulting from a disease, injury, or other trauma. Typically, a sequela is a chronic condition that is a complication of an acute condition.

ALL PARTY PARLIAMENTARY GAS SAFETY GROUP

The All Party Parliamentary Gas Safety Group provides an opportunity for Parliamentarians, gas industry representatives and other key stakeholders to discuss issues affecting the gas industry and consumers, including carbon monoxide poisoning, security of installation and supply, skills shortages, fuel poverty, irresponsible landlords, and the effects of social exclusion.

The Group's members are committed to raising awareness of the dangers of carbon monoxide and other related issues amongst Parliamentarians, the Government and the general public. It is cross-party and independent. The Group also hosts regular events for Parliamentarians, civil servants and key industry players, to enable discussion, idea sharing and the dissemination of information relating to gas safety matters.

With special thanks to John Arnold, Rosanna Fforde, Sally Percy and Laura Wilton.

Designed by Richard P Chapman Design Associates
Illustrations by Lucy Davey