A REVIEW OF CARBON MONOXIDE INCIDENT INFORMATION, FOR 2010/11, PRODUCED FROM THE INVESTIGATION OF DOMESTIC INCIDENTS WHICH INVOLVED MAINS NATURAL GAS AND PIPED LPG IN GREAT BRITAIN, INCLUDING AN ASSESSMENT OF INCIDENTS INVOLVING SOLID FUEL AND OIL APPLIANCES

Carbon Monoxide Incident Report

gas safety trust™

Working in partnership

A review of carbon monoxide incident information, for 2010/11, produced from the investigation of domestic incidents which involved mains natural gas and piped LPG in Great Britain, including an assessment of incidents involving solid fuel and oil appliances

Prepared by **Downstream Gas Ltd**
J Hayton, J Moseley, G Pool
Website:**www.downstreamgas.co.uk**

Funded by **The Gas Safety Trust**
Website: **www.gas-safety-trust.org.uk**

This report has been prepared by Downstream Gas and is funded by The Gas Safety Trust as a continuation of the work established during a Joint Industry Programme (JIP) addressing carbon monoxide (CO) issues in 1996. This work identifies common concerns involved in carbon monoxide incidents related to appliance and system design, the home environment, installation, servicing and maintenance. The conclusions reached are intended to help further improve safety, to target investment on carbon monoxide incident prevention and to identify additional research work.

This is the fifteenth report in a series that began with the publication of a first annual report in 1996 and covers the 12 months between 1st July 2010 and 30th June 2011. During this period details of 50 domestic incidents were submitted to Downstream Gas and their analysis constitutes the main part of the report. This report also appends for the first time an assessment of domestic solid fuel and heating oil incidents as reported by HETAS and OFTEC to whom thanks are accorded for their assistance in this project

The Gas Safety Trust is pleased to fund this report and believes the information and data contained within to be crucial to the further reduction in fatalities or serious injuries from accidental carbon monoxide exposure.

Contents

Tables and Figures

Executive Summary

This report has been prepared by Downstream Gas and is the fifteenth that has analysed accidental carbon monoxide (CO) poisoning incidents in Great Britain associated with the use of mains natural gas and piped LPG in the home.

This annual report covers the period from 1st July 2010 to 30th June 2011.

50 incidents were reported by investigators this year associated with the use of domestic mains natural gas and these resulted in 101 casualties (non-fatal) and 8 fatalities. This is slightly fewer incidents than 2009/10 (57) and 2008/9 (56) although it is too early to say whether this reduction in the number of incidents is due to natural variability or represents a definite trend. Of the 8 accidental fatalities reported this year involving natural gas use in the home, five were associated with central heating appliances, two with cookers and one with a space heater. The total is twice the figure for 2009/10, half the figure for 2008/9 and close to the average of 9.5 fatalities per year recorded over the last ten years. This is in marked contrast to the average of the late nineties and the early years of the 21st century of 22 fatalities per year.

The risk of an incident occurring was 0.96 per million people at risk per year, the risk of a fatality was 0.155 per million people at risk per year and the risk of a non-fatal casualty was 1.94 per million people at risk per year.

Around 20% of the reported casualties in 2010/11 were categorised as less severe (not requiring hospital treatment). This is a slightly lower proportion than in 2008/9 and 2009/10 but compares to an average of only 11% prior to 2008/9. This suggests a greater proportion of incidents are being identified before serious injury takes place and one contributory reason may be an increased use of carbon monoxide alarms.

Specific outcomes this year from assessing the incident information submitted by investigators and their co-ordinators included the following:

- back boilers featured in 5 out of 19 incidents where boiler types were recorded by the investigator and this is a disproportionately high number
- condensing boilers appeared to pose a similar level of risk to non-condensing appliances although this was attributed to poor installation and third party interference rather than any inherent defect in appliance design
- open-flued appliance installations once again featured in a disproportionately high number of incidents compared to room-sealed appliance installations
- information related to carbon monoxide alarm performance included incidents being reported despite an alarm sounding, alarms alerting occupants to a discharge of carbon monoxide in a property and alarms not functioning at incident sites (e.g. battery removed)
- a number of incidents were unable to be investigated fully for a variety of reasons, despite there being a legal obligation on the gas supplier to do so.

Conclusions and recommendations from this year's report include the following:

- the use of consistent and accurate information should be encouraged when quoting carbon monoxide incident statistics in the media
- incident numbers rather than the number of fatalities per year should be the preferred indicator for assessing how successfully the issue of accidental carbon monoxide exposure is being dealt with by the gas industry
- consideration should be given to updating the DIDR form in order to gather more information on how effectively an alarm has been protecting domestic gas users
- updating appliance population estimates nationwide, particularly those for warm air units and space heaters in order that reliable levels of risk can be determined
- gas suppliers should arrange for a full investigation of all reportable gas related incidents as is required by law so that information aimed at helping prevent personal injury from carbon monoxide exposure can be made available.

This year, information has also been submitted by investigators working on behalf of the solid fuel and oil sectors so that dedicated incident databases can be developed for each of these energy sectors.

The work done in this respect has:

i) Demonstrated that the lack of regulation in these sectors can adversely affect the number of incidents that are identified and fully investigated

ii) Indicated that the risk of being fatally injured through carbon monoxide exposure from a solid fuel installation in the home is 45 times greater than that associated with a gas installation.

1 Introduction

1.1 Context

Downstream Incident Data Report (DIDR) forms are completed by investigators following the investigation of accidental carbon monoxide poisonings in Great Britain from the use of mains natural gas or piped LPG in the home. The information received has been gathered, placed on a database, analysed and presented in a series of consecutive annual reports from 1996/7 to 2009/10. The initial reports were funded by the Health and Safety Executive (HSE) with the CORGI Trust taking over the funding for the reporting period starting in April 2006.

This is the fifteenth report in the series and is the fourth produced by Downstream Gas for The Gas Safety Trust (formerly The CORGI Trust). It covers incidents reported and confirmed during the 12 months between 1st July 2010 and 30th June 2011.

1.2 Scope

The gas industry has clear mandatory obligations and responsibilities in terms of reporting gas related carbon monoxide incidents. These are specified in the Gas Safety Management Regulations (GSMR) 1996 and in particular place duties upon the supplier of mains natural gas and piped LPG.

The GSMR state that:

> *Where an incident notifiable under regulation 6(1) of the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 has arisen as a result of an escape of carbon monoxide (CO) from incomplete combustion of gas in a gas fitting, the person who supplied the gas shall, as soon as is reasonably practicable after receiving notice of the incident, cause an investigation to be carried out so as to establish, so far as is reasonably practicable, the cause of the escape and accumulation of the carbon monoxide gas.*

The Regulations referred to above are known as RIDDOR.

Regulation 6(1) states that:

> *Whenever a conveyor of flammable gas through a fixed pipe distribution system, or a filler, importer or supplier (other than by means of retail trade) of a refillable container containing liquefied petroleum gas receives notification of any death or major injury which has arisen out of or in connection with the gas distributed, filled, imported or supplied, as the case may be, by that person, he shall forthwith notify the Executive of the incident, and shall within 14 days send a report of it to the Executive on a form approved for the purposes of this regulation.*

The Executive is the Health and Safety Executive.

The Guidance to Regulation 6(1) states that:

> *The trigger for a report to the HSE under regulation 6(1) is the receipt by the person on whom the reporting duty is placed of 'notification' of a flammable gas incident causing a death or a major injury other than one reportable under regulation 3(1).*

Regulation 3(1) relates to a fatality or major injury as a result of an accident arising out of or in connection with work whether or not the person was at work. It also covers hotel or care home residents, pupils or students and customers in shops.

For this report it may be interpreted that Regulation 6(1) covers domestic premises.

As specified in GSMR, a carbon monoxide incident has to satisfy specific criteria in order to be formally reported. Such an incident is notifiable under regulation 6(1) of the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 and for this reason is frequently known as a RIDDOR reportable incident.

Primarily, following the inhalation of a substance (in this case CO) the incident has to result in:

- an acute illness requiring medical treatment or
- a loss of consciousness

An acute illness means:

- one that progresses rapidly to a crisis after the onset of symptoms and
- has severe symptoms

Medical treatment covers:

- hospital treatment
- treatment by a general medical practitioner or
- treatment by a firm's medical and nursing staff

Treatment by a paramedic is also included here.

Based on the gas industry's duty to investigate carbon monoxide related incidents, the DIDR process was set-up to achieve the systematic gathering of details from incident investigations in order to help identify trends and common underlying features.

Incidents that occur in domestic properties attached to shops, offices, restaurants, etc are only included if the causes were related to the domestic use of gas. Incidents involving multiple residential properties such as student accommodation and sheltered housing are included but care homes are excluded as the latter are work related. Occasionally DIDR forms are completed for incidents occurring in non-domestic premises so for completeness, any received are included in a separate Appendix and these details will not feature in the statistical analysis of data covered in the main body of the report.

The reporting of LPG incidents via the DIDR forms is limited to those associated with refillable LPG tanks or cylinders. Incidents related to portable LPG are not RIDDOR reportable but occasionally completed forms are received by Downstream Gas.

An incident investigation and systematic reporting scheme for heating oil, kerosene and solid fuel started in July 2010. Data was collected using modified versions of the form used for gas incidents. It is a cross industry initiative co-ordinated by Downstream Gas between the Gas Safety Trust, OFTEC (Oil Firing Technical Association) and HETAS (Heating Equipment Testing and Approval Scheme).

The statistics in the main body of the report:

- Include data on DIDR forms that relate to the use of mains natural gas in the home.
- Exclude any DIDR forms that relate to carbon monoxide incidents involving mains natural gas or piped LPG in non-domestic situations. However, for completeness any such information received on DIDR forms is presented in an Appendix A to this report.

1.3 Coverage

The information gathered during an incident investigation relies on the investigators, working on behalf of gas suppliers, completing a DIDR form for each carbon monoxide incident and sending it to Downstream Gas for entry onto the database. Fatalities resulting from those incidents confirmed to have been caused by accidental exposure to carbon monoxide and reported to Downstream Gas via DIDR forms have been reconciled with information recorded by the HSE.

The primary aim of the work is to examine in detail the circumstances of all carbon monoxide incidents to reveal any common concerns and conclusions that will help to improve gas safety in the future. It is therefore important that detailed investigations are carried out on as many incidents as possible that meet the criteria for an investigation by law. There is a duty in law on the gas supplier to carry out such investigations and it should be recognised by both HSE Inspectors and the gas suppliers alike that this needs to happen irrespective of whether the HSE intends to take any further legal action or not.

For the period 1st July 2010 to 30th June 2011, 50 incidents were reported involving mains natural gas and none involving piped LPG. Details of one incident involving a portable LPG appliance were received on DIDR forms and for completeness these are reported separately in Appendix A.

In a fully detailed DIDR report submitted following an investigation, the investigator completes all sections thereby providing detailed information on the circumstances of an incident including, for example, the appliance installation, safety devices found on site and dwelling characteristics. This year, full details were submitted for 32 of the 50 incidents reported.

Short reports only feature brief details and tend to only include the incident date, geographical location, casualty details and the suspected cause together with the type of appliance involved. This year 18 such reports were submitted by incident investigators.

Reasons given for being unable to provide fully detailed reports were:

- The HSE had indicated no further action was necessary (4)
- The appliance had been removed or the installation had been repaired before the investigation could take place (10)
- The occupant would not allow an investigation taking place (2)
- Unknown (2)

Full reports formed 64% of those submitted in 2010/11 and this was lower than last year (80%) but similar to the previous year (68%)[1]. The main reason for the reduced level of detailed reporting was that the appliance had been repaired or replaced before an investigation could take place (10).

1 Section 4 Ref 1.

There may be occasions when a report is delayed, for example whilst waiting on the result of an inquest or a trial. No details of previously unreported incidents were received this reporting year and hence no changes to the historical headline figures are necessary.

After reconciling the number of fatal incidents reported by British Gas, CORGI Services and the Gas Safe Register with those recorded by the HSE, the data provided to Downstream Gas in DIDR forms has been thoroughly analysed and is presented in this report. Tables and charts are included relating to the numbers of reported fatalities, non-fatalities and incidents.

There are instances in this report where a particular demographic factor relating to the risk of being involved in a carbon monoxide incident (for example the number of incidents reported by investigators to have occurred in a particular type of occupancy) is compared to the number that would have been expected if every classification (in the case of occupancy type this is owner-occupied, rented in the social sector and privately rented) had been equally at risk.

Sometimes the number of reported incidents was lower than expected, in which case the demographic factor indicated greater risk than would be expected, and vice versa. In this way, commentary can be given on whether demographic factors such as property tenancy occupancy type, property type, period of property construction, glazing type, casualty age range, etc indicated levels of risk that were greater than or less than those anticipated. As an example, if gender was the demographic factor and 40 females had been reported as non-fatal casualties during the year compared to 20 males, then because the population is split 50:50, corresponding to an expected number of 30 for each gender, this would indicate that females are more at risk of being casualties than males.

The risk of an accidental carbon monoxide poisoning associated with the use of natural gas has been calculated and expressed in terms of fatalities, casualties or incidents per million people deemed to be at risk per year. People considered at risk are those living in properties with at least one gas appliance (i.e. those supplied with mains natural gas nationwide). Risk rates associated with particular appliance types have been estimated by taking the number of people at risk as those living in homes with the particular appliance type installed.

In order to report annual trends, fatality, casualty and incident rates are presented for the yearly periods starting from the 1st July 1996.

Section 2 of this report analyses data in the same sequence as it is featured on the DIDR form and interprets information making use of appliance population statistics, where available. Section 3 then draws conclusions and where appropriate lists recommendations.

- **Appendix A** gives information on domestic LPG incidents reported to Downstream Gas on the DIDR form. One incident was reported fully this year following investigations by CORGI Services.
- **Appendix B** gives information on non-domestic incidents should they be reported to Downstream Gas on the DIDR form. Three such incidents were reported fully this year.
- **Appendix C** provides details of incidents that occurred in previous years for which information was made available this year. No such incidents were received this year.

- **Appendix D** provides detailed information and provisional risk assessment for domestic carbon monoxide incidents caused by installations fuelled by solid fuel and oil. This information has been gathered by trained investigators working on behalf of HETAS and OFTEC, the trade associations for solid fuel and oil use respectively, and is featured in this report for the first time.
- **Appendix E** features charts which present summarised information for 2010/11 which enables the reader to assess elements of this year's data from mains natural gas use and compare these with data from previous years.

1.4 Media reporting

Carbon monoxide fatalities and injuries are very tragic and can be avoided so we should never ever become complacent in the pursuit of a zero target.

Quite often we see statistics and figures reported in the media that quote around 50 carbon monoxide fatalities per year. It should be noted that this high figure relates to carbon monoxide fatalities across the range of fossil fuels such as solid fuel, oil, wood and natural gas and involves a wide variety of appliances e.g. boilers, fires, garage compressors, barbecues and stoves.

The information contained within this report originates from the data captured within the RIDDOR process which is thoroughly investigated, reviewed and critiqued before being published. The RIDDOR statistics relate to carbon monoxide fatalities and injuries linked to mains natural gas and piped LPG within the UK and the number of fatalities confirmed from carbon monoxide last year and this year were 4 and 8 respectively. This is from a population of gas users numbering approximately 20 million nationwide.

The current situation regarding carbon monoxide incidents clearly shows how the numerous gas safety initiatives implemented over the last 25 years have been seen to make a real difference. Initiatives such as:

- the introduction of the flue gas analyser
- the removal of open-flued water heaters from bathrooms and bedrooms
- increased user awareness enhanced by the OFGEM supplier licence review
- landlord legislation
- boiler scrappage schemes
- the benefits of CO alarms and
- the focus of CO Charities, Industry and Government

are all contributing to this downward trend in CO fatalities and injuries linked to mains natural gas and piped LPG.

It is nonetheless important, however, to ensure the numbers of injuries reported in the media, fatal or otherwise, accurately reflect those associated with the specific fuel sector concerned. This will go some way towards making sure the lessons learned and implemented in the mains natural gas and piped LPG sectors are adopted to promote safe practice in other fuel sectors, most if not all of which are far less regulated.

The solid fuel and oil sectors are both extremely keen to work with the gas industry to help reduce the number of injuries, both fatal and non-fatal, from carbon monoxide and by providing detailed incident information for this report are expressing their commitment in this respect.

2 Analysis of DIDR Forms

2.1 Preliminary overview

There were 50 domestic mains natural gas incidents reported on DIDR forms that met the criteria for inclusion during the 12 month reporting period (1st July 2010 to June 30th 2011)[2]. There were none reported concerned with piped LPG. Those criteria that have to be met have been specified in Section 1.2. Confirmation that the victim or victims were exposed to excessive levels of carbon monoxide is typically obtained via blood tests or following examination of an installation shown to be producing dangerous levels of carbon monoxide when investigated in the 'as found' condition. Deliberate acts such as suicides are excluded.

A further incident involved the use of portable LPG. This is excluded from the main analysis as it falls outside the scope of the analysis but included in appendix A for completeness's sake.

All domestic carbon monoxide incidents referred to in this report were a result of natural gas usage unless otherwise stated.

Carbon monoxide incidents are usually notified directly to British Gas and CORGI Services both of whom provide an investigation service to a number of gas suppliers. Gas Safe Register and the HSE are also becoming involved in incident investigation. During this year, 32 confirmed carbon monoxide related incidents were investigated by British Gas, 15 by CORGI Services, 2 by Gas Safe Register and 1 by the HSE.

Of the 50 natural gas domestic incidents reported, 32 were fully reported. Information on the remainder was supplied on short (or less detailed) reports. Thus, whilst for 50 cases the analysis covers incident date, casualty information and main appliance data (see sub-sections 2.1, 2.2 and 2.6), for 32 of these the analysis was more comprehensive and covered, for example, incident appliances, flues, ventilation provision, appliance operation and servicing (Sections 2.3-2.13 inclusive).

Each DIDR form completed and submitted by an investigator is dedicated to a separate carbon monoxide incident. The incident rates and yearly trend data have been combined with the casualty information and are described below in Section 2.2.

Each of the following Sections includes an assessment of the information retrieved from the carbon monoxide incident database for 2010/11 and, where appropriate, a discussion of the data. This discussion may relate this year's information with that from previous years or qualify this in terms of a wider context.

2 Two additional suspected, but not yet confirmed, fatal incidents are still under investigation and are understood to involve legal proceedings. If the proceedings conclude they are accidental and carbon monoxide related they will be included in future reports when the details become available.

2.2 Incident details - Section 1 of DIDR

The numbers of carbon monoxide incidents recorded each month, i.e. those involving fatal and/or non-fatal casualties between 1st July 2010 and 30th June 2011 inclusive, are plotted in Figure 1. Figure 2 shows how these monthly figures break down in terms of the fatalities and non-fatal injuries. The so-called heating season, the period during which the majority of carbon monoxide incidents tend to occur, typically runs between September/October and April/May.

Figure 1 Monthly incident numbers

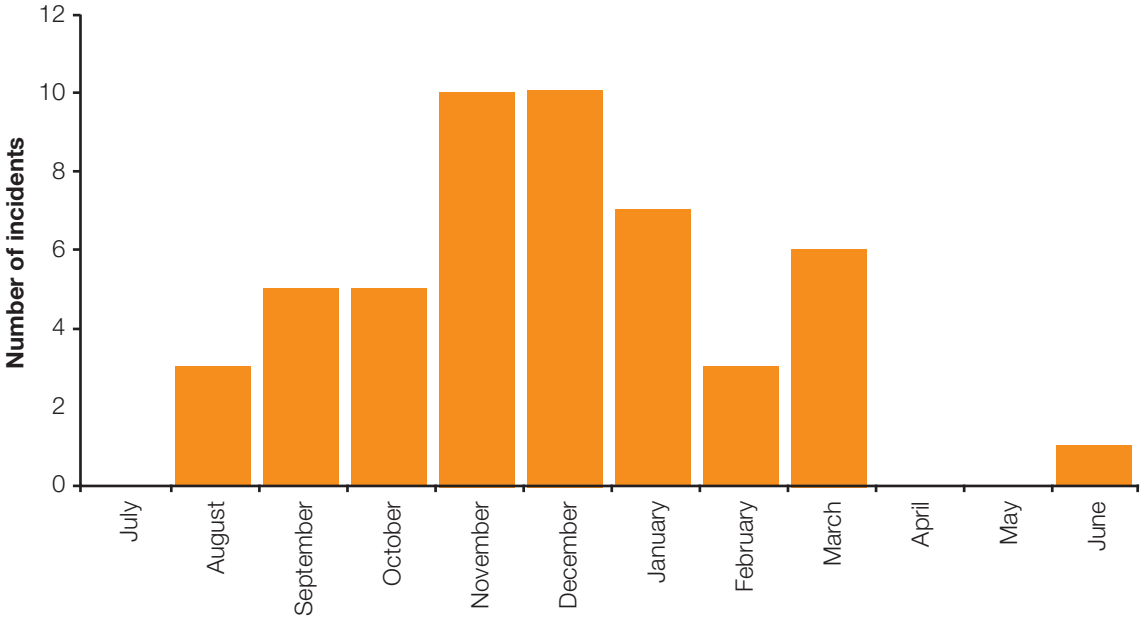
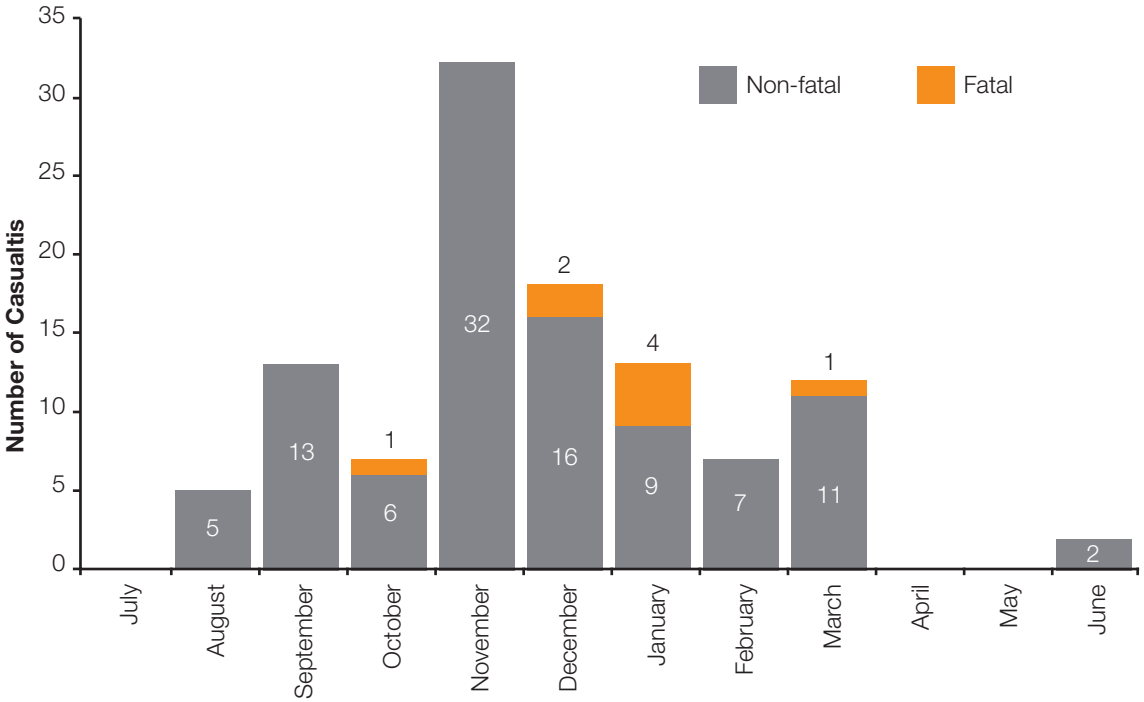


Figure 2 Monthly casualty numbers



For the period 1st July 2010 to 30th June 2011 there were 50 separate carbon monoxide incidents reported related to natural gas. These affected 109 people, of whom 8 died. The number of fatalities has been reconciled with figures recorded by the HSE.

2.2.1 Geographic coverage

Most incidents occurred only once or occasionally twice in a postal town/city, with the bulk of postal towns/cities not experiencing an incident. There tended to be a wide geographical spread throughout England, Scotland and Wales.

The one exception to this was four incidents which occurred in the Birmingham postcode area (postcode starting with B). The Birmingham postcode area has a population of 1,848,030 in 763,387[3] households and this represents an incident rate nearly 2.8 times the national average. However, given there are 119 postal areas in the whole of England, Scotland and Wales, there is a significant chance that four incidents will occur in one of them and therefore this incident rate is not particularly unusual and certainly not statistically significant.

2.3 Casualty details - Section 2 of DIDR

2.3.1 Fatalities, casualties and incident numbers

A breakdown of those persons (101) reported as having been injured although not fatally by carbon monoxide poisoning during the reporting period 20010/11 is presented in Table 1 and in Figure 3, with the severity of the casualties classified into four groups.

Table 1 Classification of non-fatalities

Classification	N1	N2	N3	N4	Not stated	Total
Number of casualties	9	64	8	10	10	101

Table Notes:

The classifications N1 to N4, as used on the DIDR form, are:-

N1 - *requiring immediate hospitalisation for more than 24 hours*

N2 - *requiring immediate hospitalisation for less than 24 hours, and/or hospital tests*

N3 - *requiring other medical treatment (e.g. GP or Paramedic)*

N4 - *receiving no medical treatment (e.g. treatment refused)*

[3] Section 4 Ref 2.

2.3.1.1 Discussion

Figure 3 shows most incidents are not fatal and the most common severity is that the casualties required immediate hospitalisation for less than 24 hours or required hospital tests.

This year nearly 20% of casualties reported were categorised as less severe (N3 or N4) and therefore did not receive hospital treatment. From Figure 4 this seems to indicate a greater proportion of casualties have been reported as less severely injured since records began in 1996 although this trend may have been levelling off over the last few years. Possible explanations for this may be that occupants are being alerted before symptoms become severe, perhaps from an increased use of carbon monoxide alarms, or possibly a general increase in the awareness of carbon monoxide symptoms. Indeed three instances were reported to Downstream Gas in detail where the alarm was triggered and it was subsequently confirmed that carbon monoxide had been discharged into the property.

Figure 3 Reported incident and casualty numbers

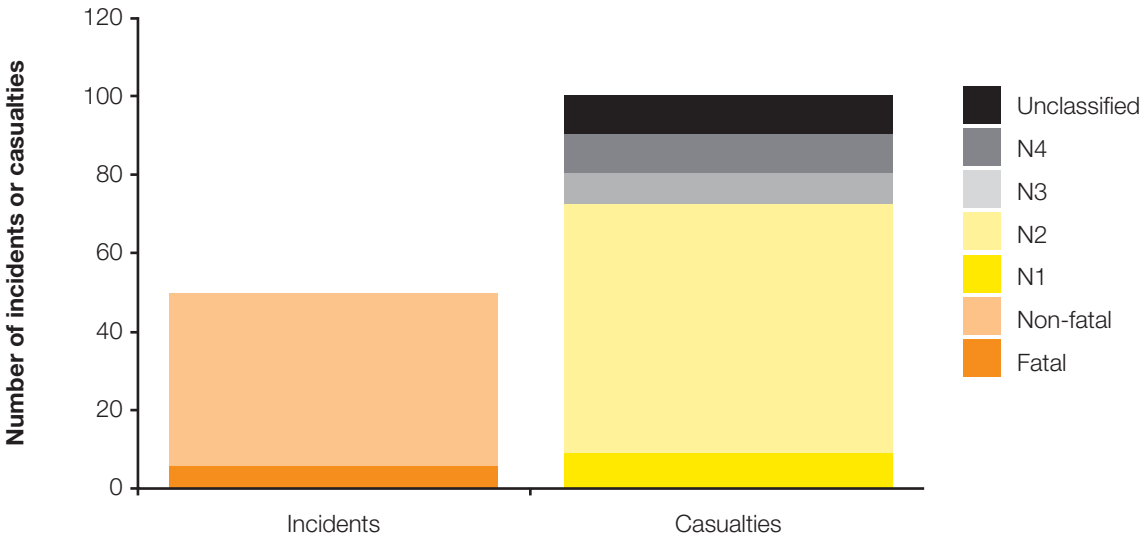
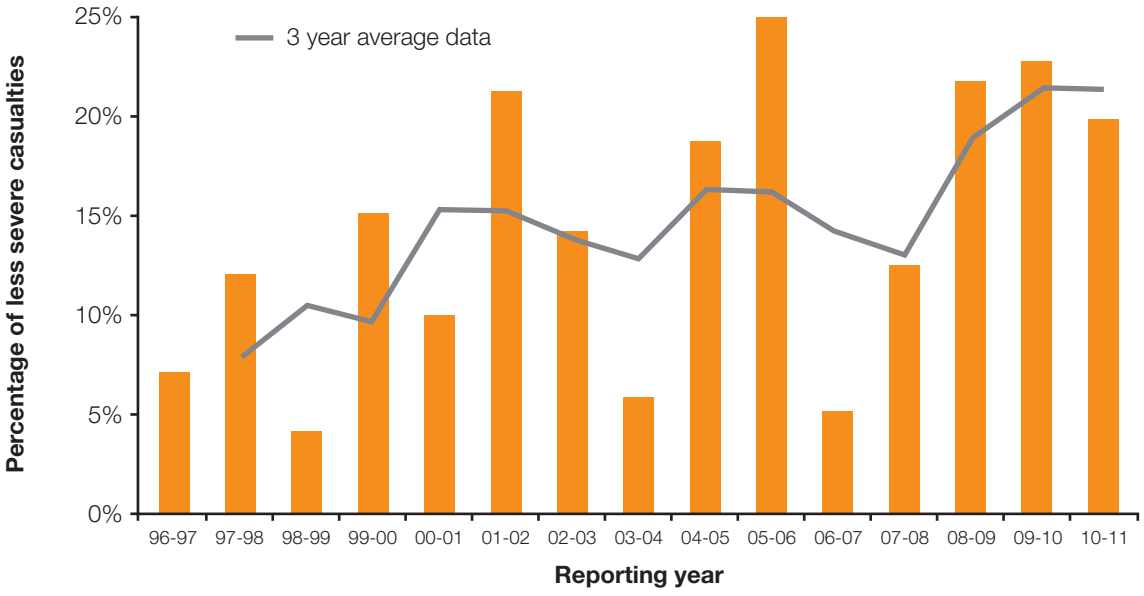


Figure 4 Percentage of casualties not requiring hospital treatment



The reported number of incidents in 2010/11 (fatal and not fatal) was 50 and the number of non-fatal casualties was 101. This is slightly lower than in 2008/9 and 2009/10. It is too early to tell whether this represents a gradual decline or is within the limits of normal statistical variation. 50 and 101 are near the reported four-year average figures since 2007/8 of 51 and 95 respectively.

2.3.2 Overall risk and trends

Table 2, shows the likelihood of someone being involved in a carbon monoxide incident. The risk rates were calculated by dividing the number of incidents, casualties or fatalities by the number of people at risk. The exact number of people at risk is open to debate but in this report, it has been taken to be the number of people that live in homes with at least one gas appliance (i.e. the number of households with mains gas multiplied by the average number of people living in a household).

The calculated risk presented in Table 2 is based on the number of households using mains natural gas of 21.7 million (86.1%[4] of 60.4[5] ÷ 2.4[6]) in 2010.

Table 2 Carbon monoxide incident numbers and risks for 2010/11

Total Incidents	Numbers of people affected		Incidents, fatalities or casualties per million people at risk per year		
	Fatal	Non-fatal	Incident	Fatality	Non-fatal
50	8	101	0.96	0.15	1.94

The risk rates calculated for previous years are given in Table 3. Yearly trends recorded for fatality and incident rates are also shown in Figures 5 and 6 respectively. The trend is defined as a moving average over three years centred on the middle year. It should be noted that for the 2010/11 year the trend is the average of 2009/10 and 2010/11 only.

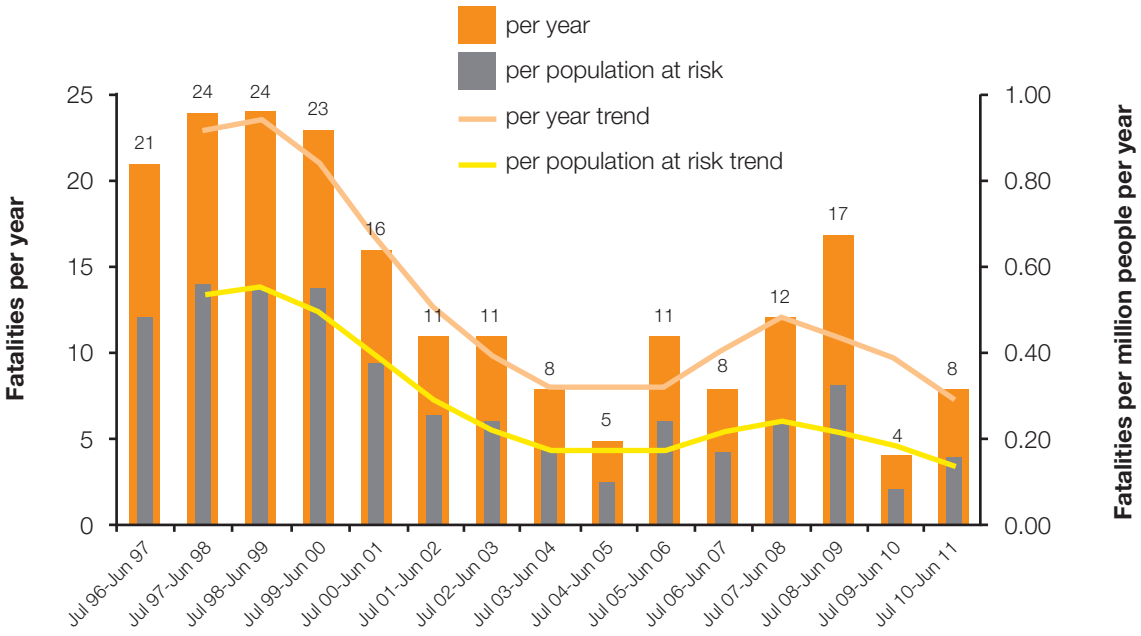
4 Percentage of homes in England with a natural gas supply table 3.1. Section 4 Ref 3
5 Great Britain Mid 2010 population estimate, ONS. Section 4 Ref 4
6 Table 1, Social Trends, 41, ONS, Section 4. Ref 5

Table 3 Yearly data (July 1st to June 30th)

Reporting year	Number per year			Overall rate per million people per year		
	Incidents	Fatalities	Casualties	Incidents	Fatalities	Casualties
96/97	70	21	142	1.64	0.49	3.33
97/98	94	24	206	2.21	0.56	4.83
98/99	107	24	241	2.49	0.56	5.61
99/00	70	23	150	1.68	0.55	3.60
00/01	85	16	206	2.01	0.38	4.86
01/02	52	11	107	1.19	0.25	2.44
02/03	36	11	66	0.79	0.24	1.44
03/04	38	8	85	0.84	0.18	1.89
04/05	25	5	48	0.55	0.11	1.05
05/06	19	11	20	0.41	0.24	0.43
06/07	27	8	40	0.57	0.17	0.85
07/08	42	12	67	0.84	0.24	1.35
08/09	57	17	97	1.11	0.33	1.89
09/10	56	4	115	1.09	0.08	2.25
10/11	50	8	101	0.96	0.15	1.94

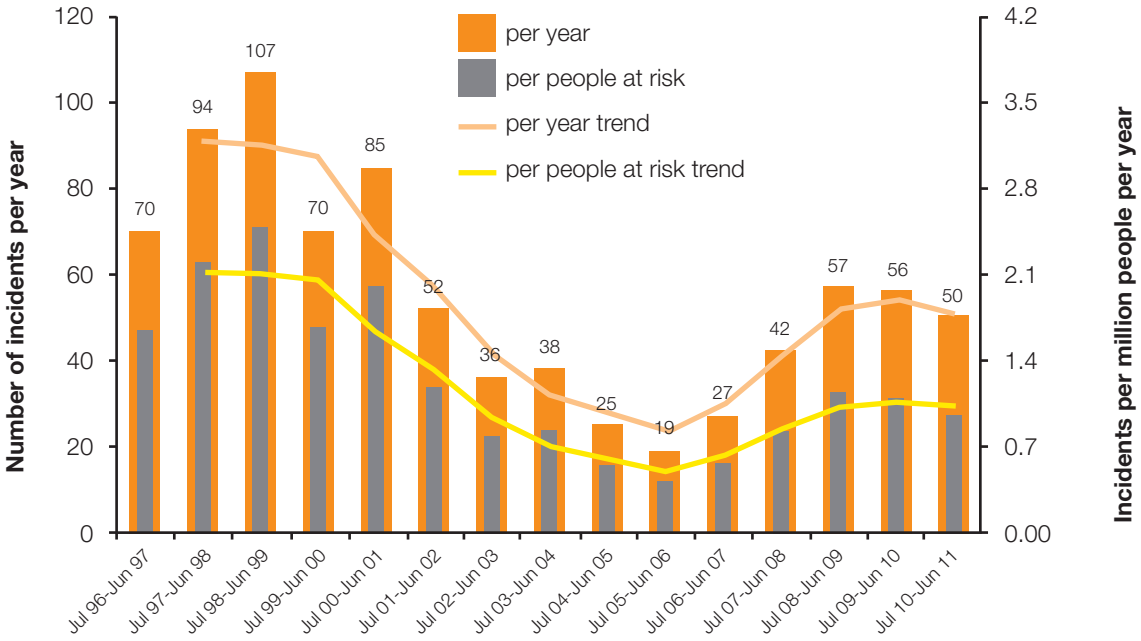
It should be noted that historical data and therefore incident rates have changed slightly following the analysis undertaken for the recently published Trends Report[7] which was based on a more accurate historical database. The improved historical database was produced following a thorough examination of entries going back to 1996 that revealed misplaced non-domestic entries (e.g. one reported in a church) prior to 2007/8 and that have since been removed.

Figure 5 Fatality data



7 Section 4 Ref 12

Figure 6 Incident data



2.3.2.1 Discussion

The number of fatalities has declined since the peak in the late nineties of 24 to an average of 10.25 per year over the past four years. This year's figure of 8 fatalities is slightly under the four-year average.

The number of incidents has declined since the peak in the late nineties of over 100 to an average of 51.25 per year over the past four years. This year's figure of 50 is below the average of the last four years.

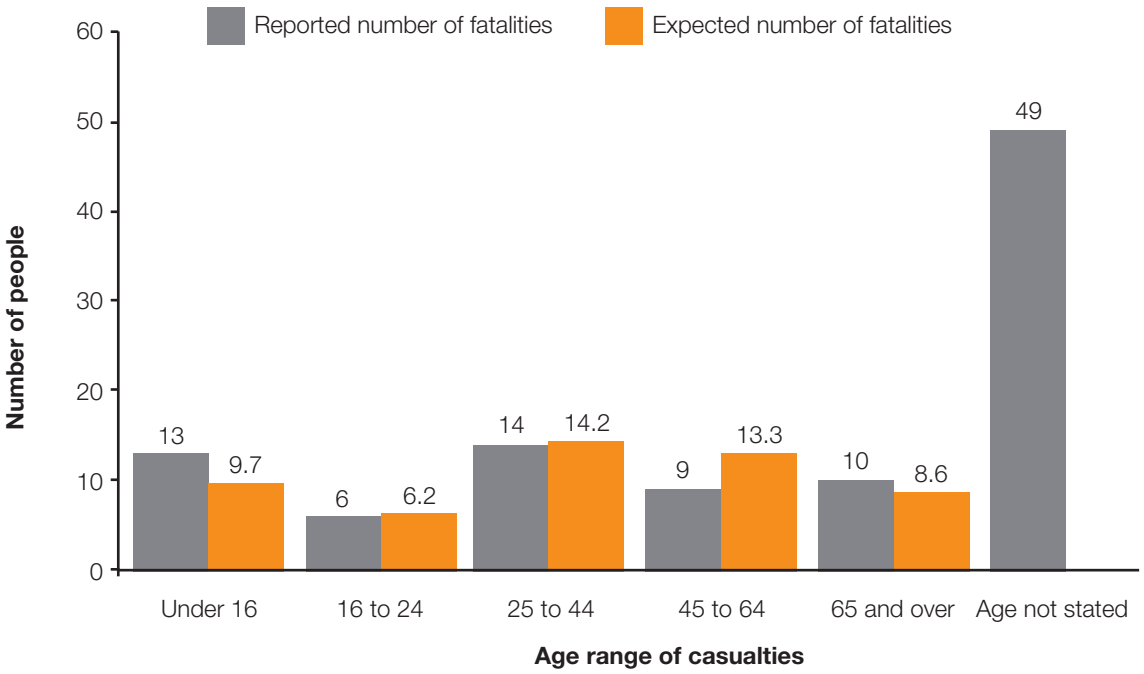
2.3.3 Casualty ages

The age ranges of people injured fatally and non-fatally are presented in Figures 7 and 8 respectively. These ranges have been deliberately chosen to represent age groups with perceived differing vulnerabilities and potential for exposure to carbon monoxide. The expected numbers of incidents by age range is also shown in Figures 7 and 8. The expected number is the percentage of those within each age range resident in Great Britain in mid-2010 (the latest available figures) published by the Office for National Statistics (ONS)[8] multiplied by the total number of casualties with an age recorded. In effect, the expected number is the average number that would occur if all ages were equally susceptible to carbon monoxide poisoning and exposed to the same level of risk.

8 18.6%, 12%, 27.3%, 25.6% and 16.6% respectively. Section 4 Ref 5.

Figure 7 Fatality age profile

Figure 8 Casualty age profile



2.3.3.1 Discussion

From Figure 8 it is evident that there are only minor differences between the age profiles of non-fatalities. Indeed, a statistical Chi-squared test shows that the reported distribution is not significantly different to that which would be expected by chance alone from the age distribution of the general population assuming all are equally at risk. However, this is an unreliable conclusion, as 49 casualties out of the 101 were of unknown age.

The eight fatalities were too few to analyse meaningfully by age groups.

2.4 Incident location details - Section 3 of DIDR

This section examines whether the risk of an incident varies with occupancy type, dwelling type, year of construction, double glazing and floor construction.

2.4.1 Occupancy type

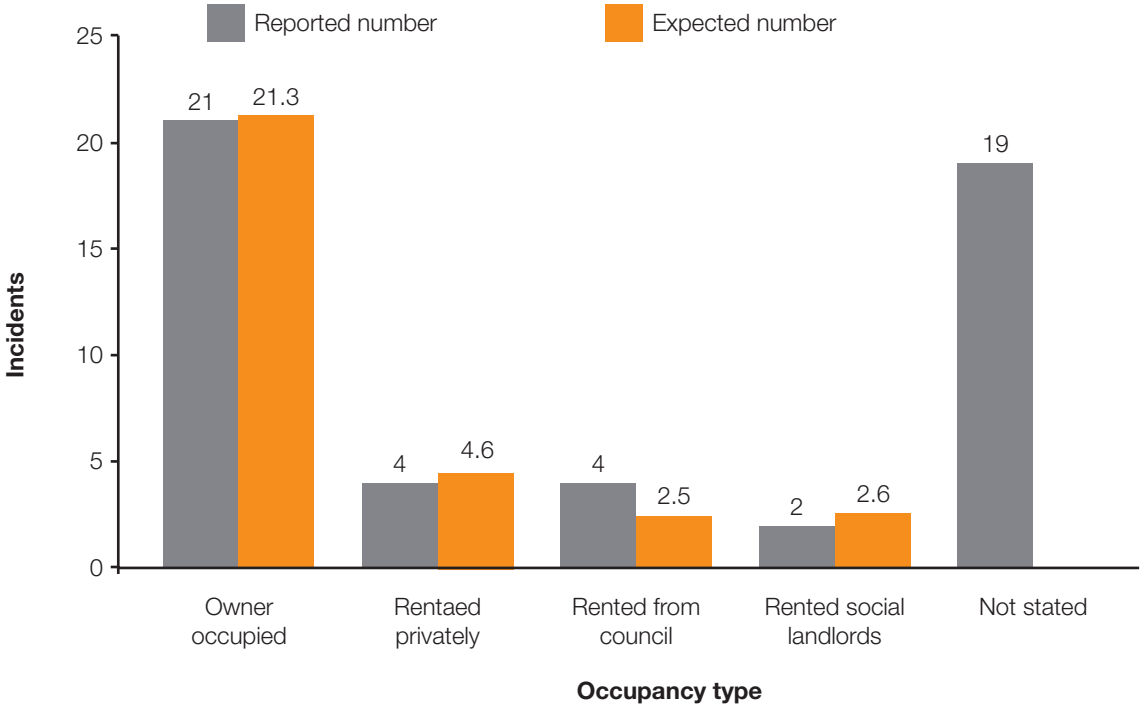
A breakdown of English homes with a gas supply in 2009 by occupancy type is shown in Table 4. This is considered to be a reasonable measure of the breakdown of gas homes in Great Britain in 2010/11 because a) England accounts for 85% of the homes in Great Britain, b) the percentage of homes with a gas supply in Wales and Scotland is similar to England and c) the number new homes built since 2009 is around 1% of the existing stock.

Table 4 Percentage of gas homes by occupancy type in England in 2009[9]

Occupancy type	% of homes with a gas supply
Owner occupied	68.6%
Rented privately	14.7%
Rented from council	8.1%
Registered Social Landlords (RSL)	8.5%
ALL	100%

Figure 9 shows the number of reported and expected incidents by occupancy type. The expected number is the national proportion by occupancy type (Table 4) multiplied by the total number of reported incidents of known occupancy type and represents the number expected assuming all occupancy types pose equal risk.

Figure 9 Incidents by occupancy type



9 Table 3.1.Section 4 Ref 3.

2.4.2 Dwelling type

Column A of Table 5 shows the percentage of properties in England by dwelling type. Column B shows that in England 84.3% of detached homes, for example, had gas as the main heating fuel. The final column shows the percentage of gas properties in England by dwelling type.

Figure 10 provides a breakdown of incidents by dwelling type and the expected number based on the national profile, were an incident in one particular type of dwelling to be equally as likely as in another type. The reported numbers of incidents by dwelling type were similar to the proportion of properties supplied with gas by dwelling type for terraced houses, flats and bungalows but not for semi-detached houses, where more were reported than would have been expected.

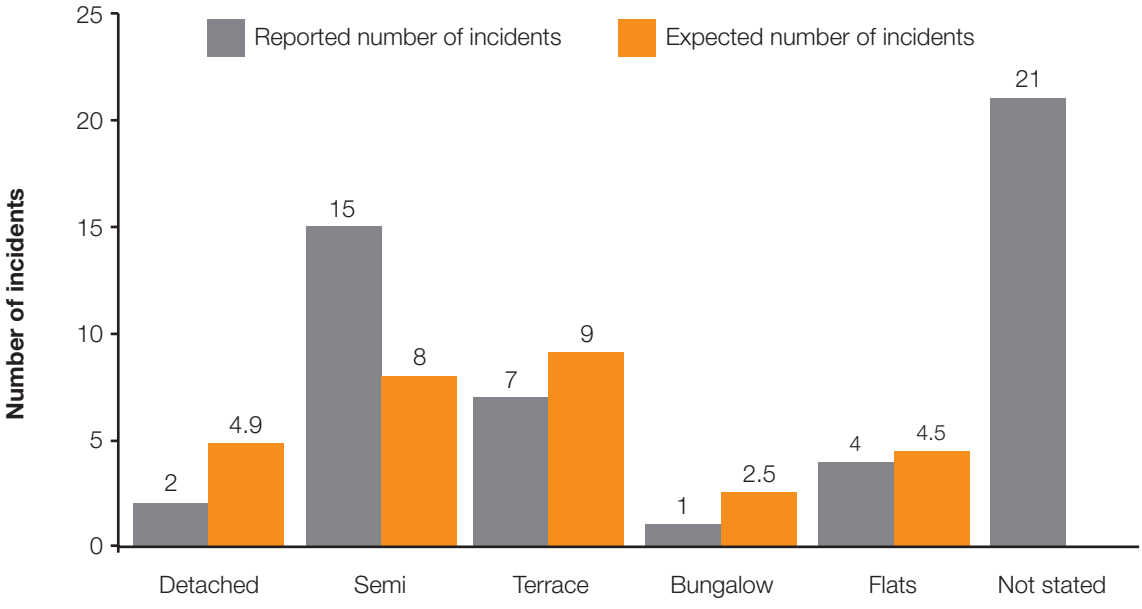
Table 5 Dwelling types in England

	% of gas and non-gas properties by type in England[10]	% of properties in England[11] that have gas the main heating fuel	% of gas properties by type in England
	Column A	Column B	A x B ÷ Total (A x B)
Detached house	17.0%	84.3%	16.9%
Semidetached house	25.6%	90.7%	27.5%
Terraced housed	28.9%	91.7%	31.3%
Bungalow	9.2%	80.9%	8.8%
Flats			
purpose built	15.3%	67.5%	12.2%
Flats converted	4.0%	71.6%	3.4%
Total	100%		100%

Table Notes:

Total (A x B) = [A(det) x B(det)] + [A(semi) x B(semi)]+ ...+ [A(conv. flat) x B(conv. flat)]

Figure 10 Incidents by dwelling type



10 Annex, table 2.3. Section 4 Ref 3.
11 Table SST6.1. Section 4 Ref 7.

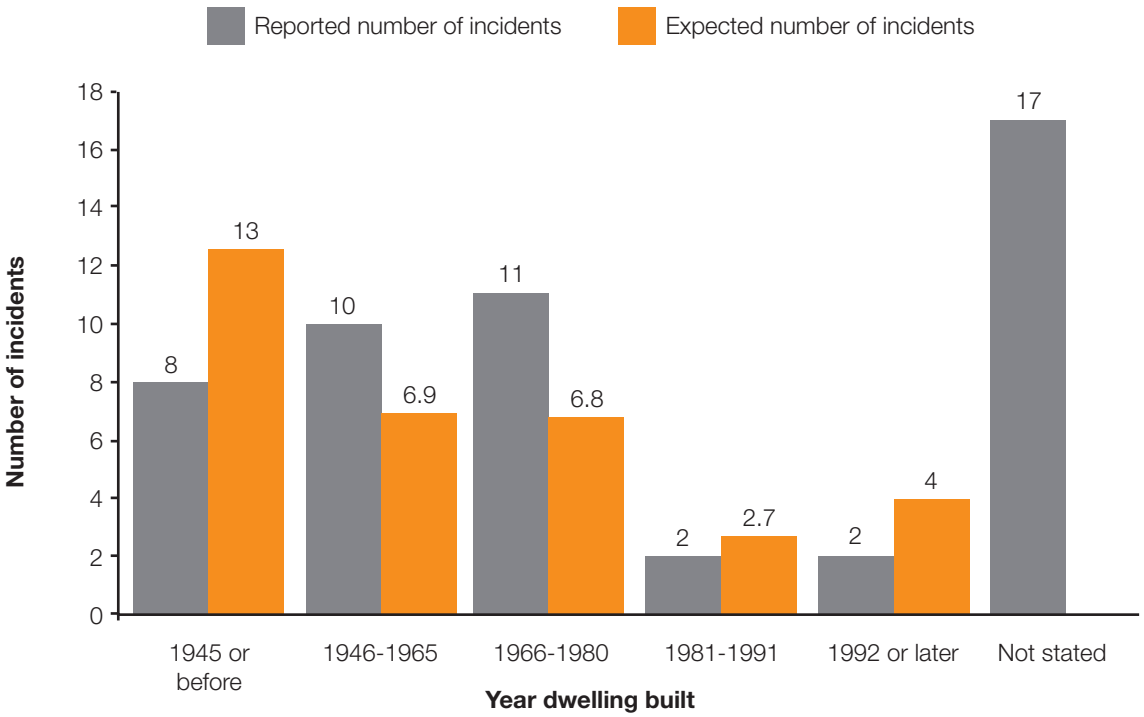
2.4.3 Property construction period

Table 6 gives the estimated national breakdown of properties in each of five periods for property types as listed on the DIDR form. Figure 11 shows the reported number and expected number (assuming all ranges pose equal risk) of incidents by property age based on the estimated national profile of the five age ranges specified on the DIDR form.

Table 6 Estimated national breakdown by property construction period

	% of English gas and non-gas properties by built era[12]	% of English properties that have gas as the main heating fuel[13]	% of gas properties by built era in England
Built era	Column A	Column B	A x B ÷ Total(A x B)[14]
Pre 1946	21.5%	86.8%	20.4%
1945 to 1965	16.5%	89.3%	17.8%
1966 to 1980	20.2%	84.5%	21.0%
1981 to 1990	20.7%	78.9%	20.5%
Post 1991	8.9%	84.9%	8.2%
Total	100%		100%

Figure 11 Incidents by property construction period



12 Annex, Table 2.2. Section Ref 3.
13 Table SST6.1. Section Ref 7
14 See Table 5 note.

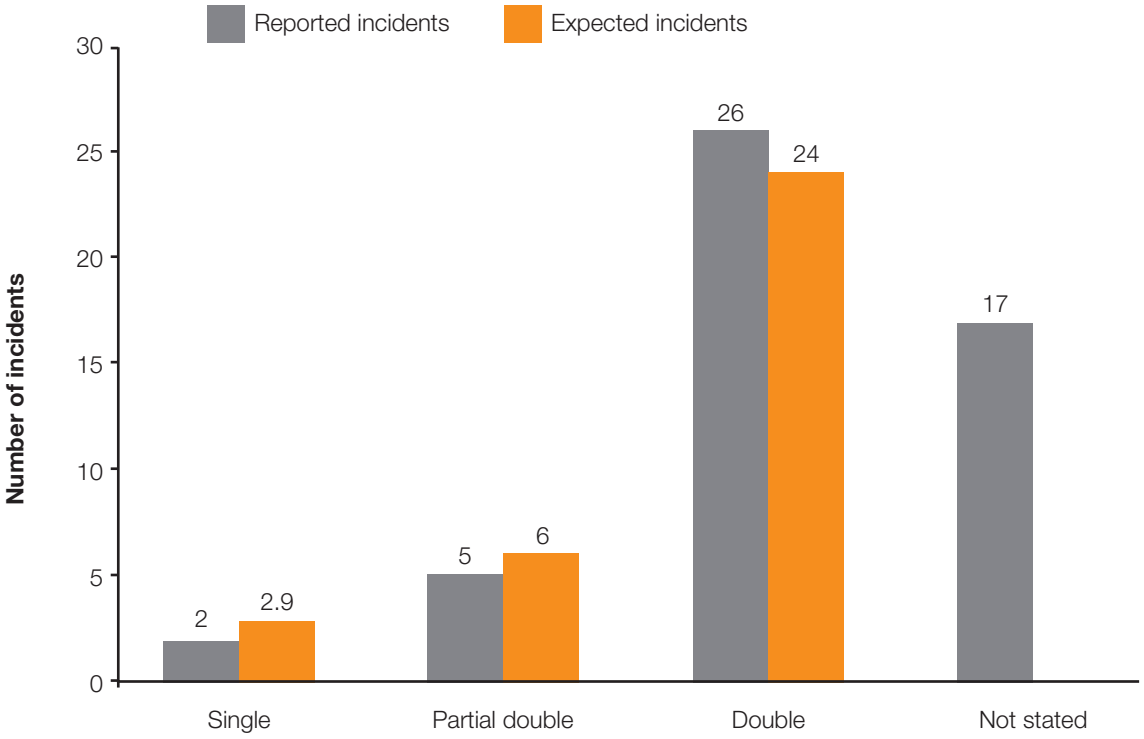
2.4.4 Glazing type

The percentage breakdown of homes by glazing type in the latest English Housing Survey (2009) was 8.8% single glazed, 18.3% partial single- and double-glazed and 72.6% double-glazed in 2009[15]. It was noted in the 2009/10 Incident report *"that it was not possible to obtain exact estimates of the relative proportions of single and mixed glazing. Instead those properties with partial double glazing were considered in the category 50% to 99% partially double glazed and those with single glazing were equated to less than 50%".*

The 2009 Survey defines the glazing categories as all single, mainly single, mainly double and all double. Hence, the assumed categorisation noted above is not required for the 2010/11 report and results in an artificial change in the percentage of dwellings categorised as single- or mixed-glazing between 2008 and 2009.

Figure 12 compares the number of reported incidents with those expected from the national figures for glazing categories assuming each category is equally at risk. In 2010/11, there were a similar number of reported incidents to those that would be expected if each category posed an equal risk. Therefore there is no statistical evidence to suggest that double glazing puts properties at more risk of being involved in a carbon monoxide incident than single-glazing.

Figure 12 Incidents by glazing details



15 Annex Table 6.9. Section 4 Ref 3.

2.4.5 Floor construction

Table 7 shows a breakdown of carbon monoxide incidents reported by ground floor construction.

Table 7 Incidents by floor construction

Ground floor construction	Reported number of incidents
Solid	24
Suspended	4
Partial solid	4
Not stated	18
Total	50

2.4.6 Discussion

In Figure 9, there is little difference between the numbers of carbon monoxide incidents reported compared with those expected assuming equal risk across occupancy type. A Chi squared test confirms this to be the case. This follows a trend over the last few years where privately rented households featured more prominently in the proportion of carbon monoxide incidents than other occupancy types.

In Figure 10, Chi-squared testing suggests that risk may vary between different dwelling types (in this case semi-detached houses). This is the first year that this has happened and suggests semi-detached properties pose more of a risk of being involved in a carbon monoxide incident than other property types. The reason for this is not known and an analysis of carbon monoxide incidents reported in future years will determine whether this is becoming an established new pattern or is simply a statistical glitch.

The property age data presented in Figure 11 suggests that there is a disparity between the number of incidents reported and those expected. However combining the "1981 to 1991" with the "1992 or later" category to make a Chi-squared statistical test valid[16] shows the disparity is not statistically different and hence there is little evidence to suggest that properties built in different periods pose different risks of being involved in an incident.

Figures 9, 10 and 11 show a significant proportion of missing data. For example in Figure 11, 17 properties were of "non-stated" built era. These were not stated because there were 18 incidents that were not reported fully. As the reason for missing data is not linked to the parameter of interest it can to be safely assumed that the missing data is likely to follow the same distribution as the fully reported data.

National statistics on floor construction are not readily available. However, an estimate in England based on property age is that 30% have suspended floor construction[17]. A similar estimate made assuming all properties with cavity walls have solid floors also produces the same result of 69.1% with solid floors[18]. If this were the case and each floor type posed a similar risk of an incident, the expected number of incidents in properties with a suspended floor construction would be 8 and for solid floor would be 20. In fact, there were 4 and 24 reported respectively and like previous years these are not significantly different. Therefore, the type of floor construction is not considered to have a bearing on the likelihood of a carbon monoxide incident occurring.

16 An expected number of five is required in 20% of the categories.
17 This assumes dwellings built before 1929 are suspended floors and those after are solid floor, which is reasonable for England and Wales. Scotland has different historic construction practices.
18 Annex Table 6.4. Section 4 Ref 3

2.5 Appliance and casualty locations - Section 4 of DIDR

This section covers the reported location (eg room or compartment) of both the incident appliance and those injured. No reports implicated more than one appliance. Details of the incident appliance locations, by floor level, are given in Table 8.

Table 8 Incident appliance location by floor level

Floor on which the appliance was situated	Number of incident appliances
Roof space	0
Second or higher	0
First	3
Ground	23
Below ground	2
Not stated	22

Table 9 lists where the incident appliances were reported to have been located together with the numbers of casualties at each location. The most common location for an incident appliance was the kitchen and living rooms.

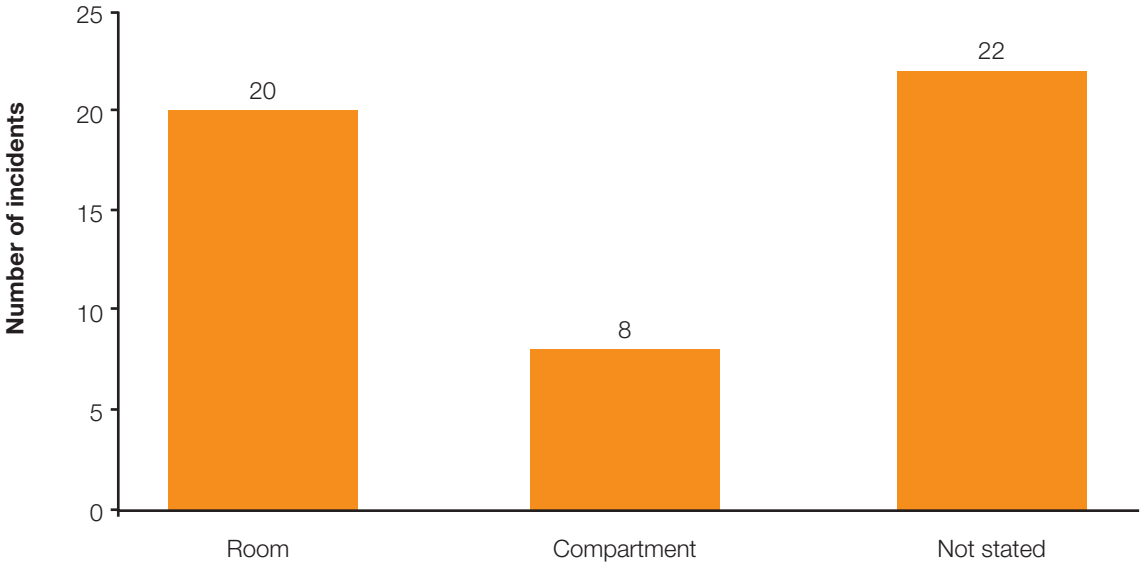
Table 9 Appliance and casualty locations

	Number of appliances at each location	Number of casualties at each location	Number affected where the occupants were in the same room as the appliance	
			Fatal	Non-fatal
Hall/landing	0	14	0	0
Kitchen	12	2	1	2
Living rooms	12	20	2	11
Bathroom	0	1	0	0
Utility	1	0	0	0
Bedroom	4	14	0	2
Other	1	1	0	0
Not stated	20	49		

The most common location for casualties was the bedroom, living rooms and landings/hallways.

A further analysis was carried out on the number of incident appliances fitted in compartments. There were 8 incidents reported that involved appliances in compartments, out of a total 28 where the relevant details were recorded. This is presented in Figure 13 and shows a similar proportion of incident appliances were fitted in a room compared to a compartment as reported in 2009/10.

Figure 13 Incident appliances installed in compartments



Of the 26 reports that provided a response to the question "was the casualty located in the same or an adjacent property?", 25 reported that they were located within the same property as the incident appliance. The exception was an installation where one person in an adjacent flat was injured and this incident was caused by a defective flue in the loft.

2.5.1 Discussion

Without data on the nationwide breakdown of appliance installations by room, it is not possible to judge the significance, if any, of the incident appliance location. The location of casualties reported during the year was not surprising given people tend to spend most time in the bedroom and living room and indeed may go to bed if they feel unwell (as may be the case when suffering symptoms of carbon monoxide poisoning).

Three fatalities were reported to have occurred in the same room as the suspected appliance. Fifteen of the 51 non-fatalities were reported to have the appliance and casualty located in the same room. These numbers may be small because the occupants might not immediately feel unwell following exposure to carbon monoxide and therefore, when symptoms do appear they may have moved to a different room. Alternatively, exposure may be a result of carbon monoxide migrating around the property.

Without the knowledge of how many appliances are installed in compartments nationwide, it is not possible to gauge the significance or otherwise of whether compartment installations are more at risk of being involved in an incident. Over the last two years a similar proportion of the detailed incident reports involved appliances installed in compartments. Installing appliances in compartments can in some circumstances exacerbate the rate at which carbon monoxide is produced and spreads around a property following appliance/installation malfunction.

The single incident which led to one casualty in an adjacent property is not an isolated instance involving injury outside the property where an appliance/installation has malfunctioned. There have been other occasional incidents recorded on the carbon monoxide incident database that have led to casualties in adjoining properties which may, for example, have shared loft spaces.

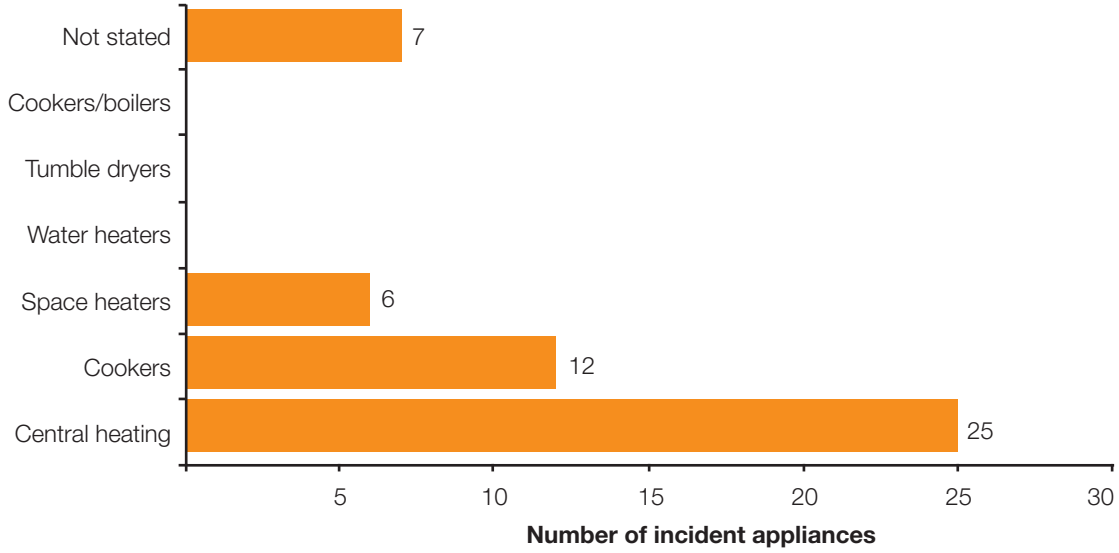
2.6 Incident appliance details - Section 5 of DIDR

This section examines appliance details to see if there are any factors that could help influence future installation and maintenance guidance.

2.6.1 Appliance type

Details of incidents classified by the appliance type are given in Figure 14.

Figure 14 Incidents by appliance type



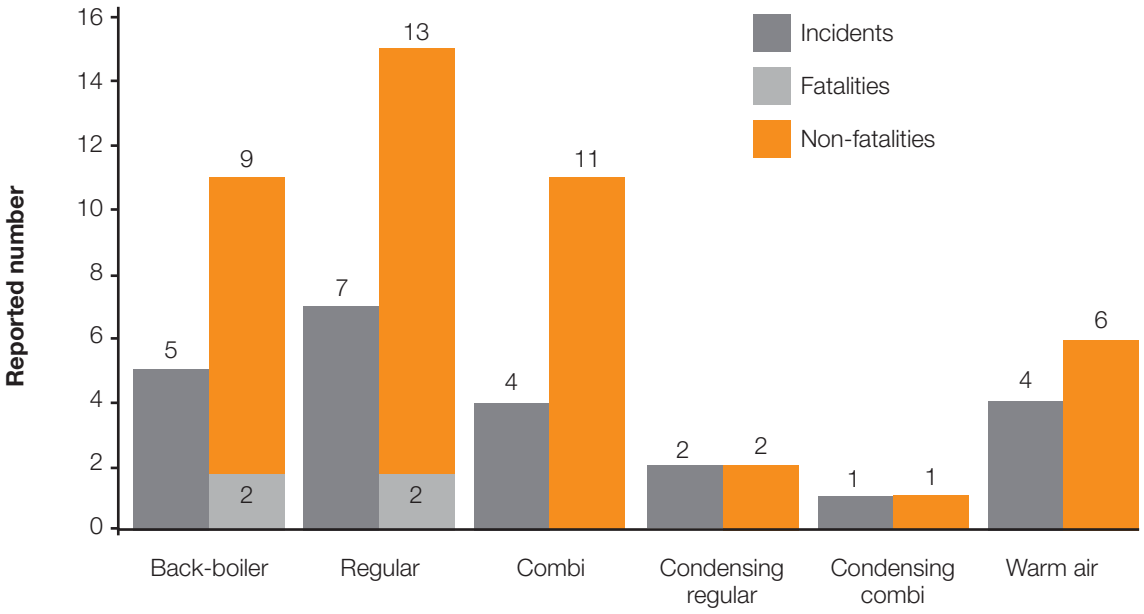
Most incidents where the appliance type was specified (43 out of 50) involved central heating appliances (25), four of which were warm air heaters (there were two last year). This is as expected given the prevalence of central heating installations, their larger heat input and the fact that they tend to be in operation for significant periods.

There were 12 incidents involving cookers.

2.6.2 Central heating and boiler type

The incident numbers involving central heating appliances are further broken down in Figure 15. One fatal incident and one non-fatal incident involved boilers of an unspecified type and therefore are not shown.

Figure 15 Incidents by central heating type



In order to establish the relative risk presented by each boiler type, the boiler population by boiler type is required. In previous reports this has been projected forward by 18 months from the estimates using the English Housing Survey that are typically 18 months behind the required period. The projections were estimated from boiler sales and by making assumptions about which boilers have been replaced. Now that condensing boilers are over 25% of the installed boiler population there is only a small change in the breakdown of the boiler population by type, year on year, making the estimated projection no longer worthwhile. For example, a change of 1% or 2% points in each category from 2009 to 2010 would occur if the figures were projected forwarded on the same basis as last year's report. The accuracy of the estimated projection due to having to make assumptions about which boilers are replaced is unlikely to be better than this year by year change.

Table 10 shows a percentage breakdown for England which has been assumed to apply to Great Britain as a whole.

Table 10 Boiler populations by type (England 2009)

Boiler type	% of dwellings by boiler type
Regular	37.1%
Back-boiler	7.5%
Combi-boiler	28.0%
Condensing regular boiler	6.8%
Condensing combi-boiler	20.7%

Source: English Housing Survey 2009 [19]

19 Annex Table 6.1. Section 4 Ref 3.

Figure 16 Reported and expected incident numbers by boiler type

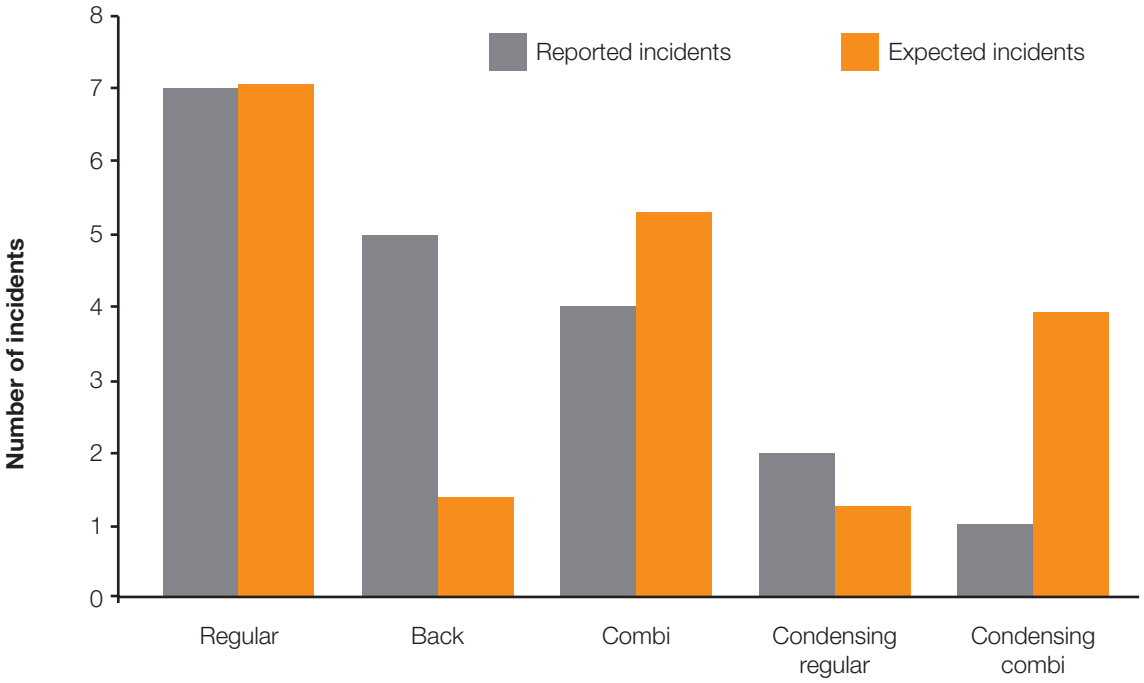


Figure 16 compares the 19 carbon monoxide incidents reported with a known boiler type with those expected given the prevalence of each boiler type in the general population and assuming each poses an equal risk[20]. There were considerably more incidents involving back-boiler units than would have been expected if all boiler types posed an equal risk. There were also considerably fewer incidents concerning condensing combi-boilers than would be expected if all boiler types posed an equal risk. The expected number in at least 20% of the categories is less than five and so too few to a carry out a Chi-square test to determine whether the differences between the expected and reported numbers of all the boiler types were statistical significant or not[21]. However, it is possible to carry out two binomial tests comparing the risk of back-boilers to other types and condensing combi-boilers to other types.

A binomial test comparing back-boilers versus non back-boilers revealed that the chance of 5 or more incidents involving back-boilers out of the total of 19 incidents with specified boiler type was 1.1% assuming all boiler types pose an equal risk. Therefore it is concluded that there is strong evidence to suggest that back-boilers pose more of a risk than other boiler types.

Binomial tests comparing condensing combi-boilers to other boilers and condensing to non condensing models revealed there was no statistically significant difference.

20 The expected number is the total number of incidents reported with a known boiler type multiplied by the percentage breakdown of boiler types in the general population.

21 In the 2009/10 report the category of regular non-condensing boilers was combined with back-boilers to carry out a Chi-squared test. This was possible because incident numbers in both categories were higher than expected. This reporting year only incident numbers with back-boilers are higher than expected and therefore merging categories will not yield meaningful results.

2.6.2.1 Appliance age

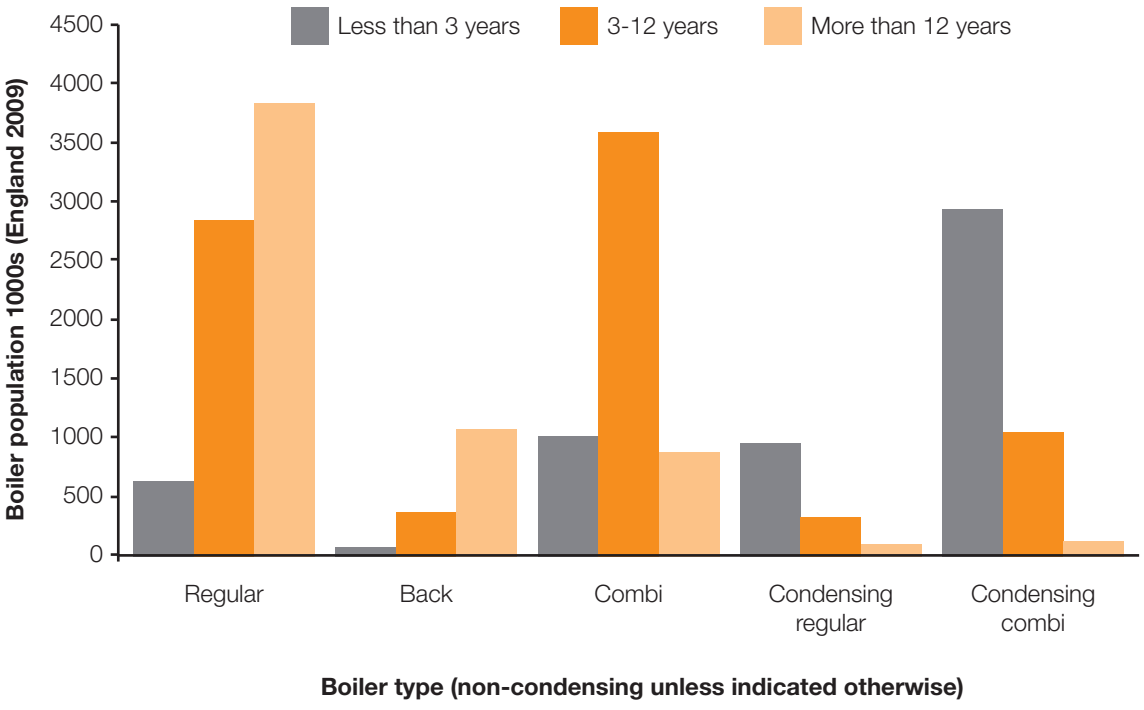
Table 11 lists the numbers of incidents reported this year by appliance age and Figure 17 shows the boiler population by age in England in 2009.

Previous reports used a population of boilers by age that was surveyed over five years ago; making the assumption that the age profile is similar in 2010/11 questionable. However, for the first time, the latest English Housing Survey gives a breakdown by boiler age which is much more reliable than the previous population figures used. The downside is that the English Housing Survey uses different age divisions than the previous source forcing the new age divisions of 3 and 12 years.

Table 11 Incident numbers by appliance age

	Appliance age (years)			
	Under 3	3 – 12	Over 12	Unknown
Cooker	1	0	3	8
Other	0	0	0	0
Space Heater	0	3	1	2
Central Heating	1	7	3	14
Water Heater	0	0	0	0
Total	2	10	7	24

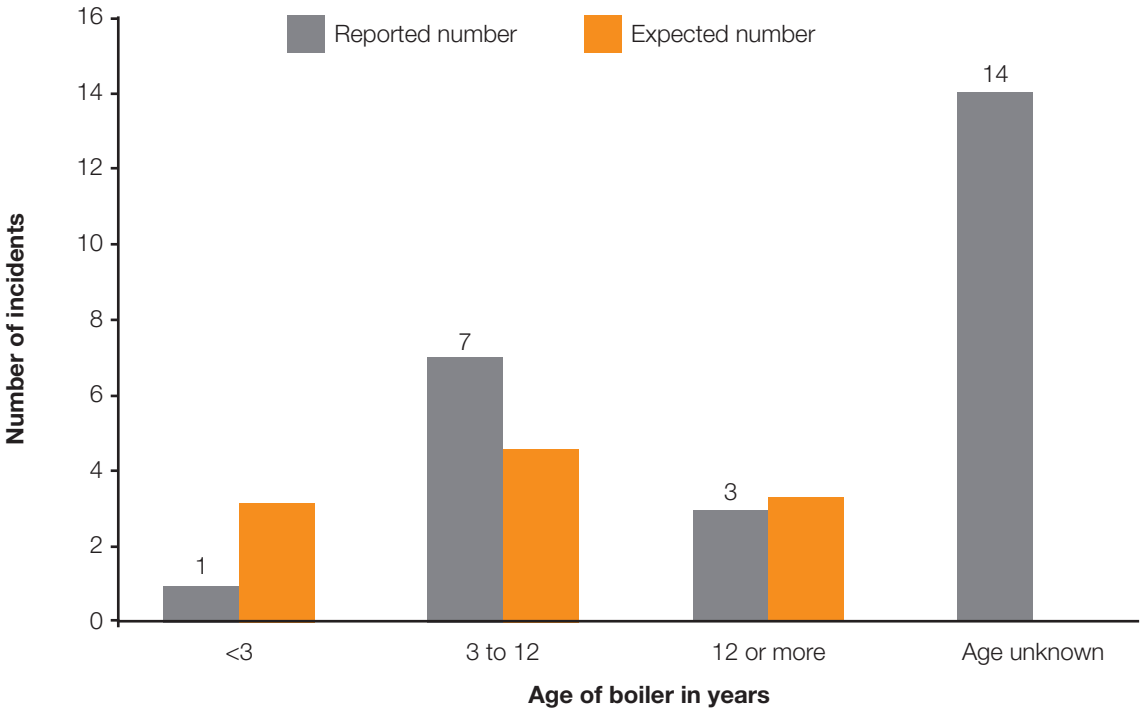
Figure 17 Boiler age profile in England 2009



Source: English Housing Survey 2009, ONS

Figure 18 shows the reported and expected incident numbers for the boilers of known age. The expected number is based on the English age profile in 2009[22] assuming boilers of different ages are at equal risk of being involved in a carbon monoxide incident.

Figure 18 Incidents by boiler age



In 2010/11 there were incidents reported involving 11 boilers of known age, 14 of unknown age and 1 over 20 years old. In 2009/10 and 2008/9 there were 17 and 20 boilers of known age involved in incidents respectively and 7 and 11 of unknown age; 6 and 7 boilers were aged twenty years or over respectively.

It is difficult to gauge whether the drop in the number of older boilers involved in incidents observed in 2010/11 is significant or not because of the increase in the numbers of boilers of unknown age. Only one boiler's age was unknown in 2010/11 because the incident details were only provided in a short report. The other 13 were due to the failure to establish the age despite a full investigation. Unlike other parameters, the boilers of unknown age are not likely to have the same age distribution as the boilers of known age because these boilers are likely to be biased towards older boilers given it is harder to identify their age.

22 Annex, table 6.11. Section 4 Ref 3.

2.6.3 Trends in incident rates

Figure 19 shows the yearly fatality numbers associated with appliance type since July 1996.

Figure 19 Fatalities by appliance type since 1996

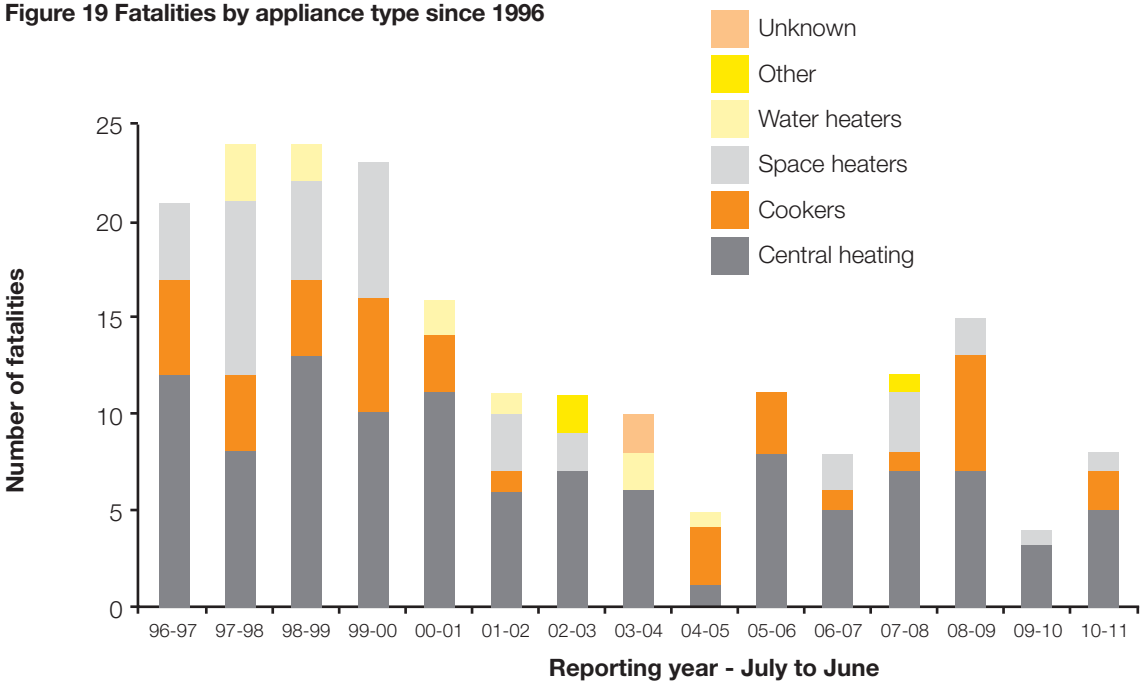


Table 12 Fatalities by appliance type since 1996

Year (July to June)	Unknown	Cookers	Water Heaters	Space heaters	Central heating	Other	Total
96/97	0	5	0	4	12	0	21
97/98	0	4	3	9	8	0	24
98/99	0	4	2	5	13	0	24
99/00	0	6	0	7	10	0	23
00/01	0	0	2	3	11	0	16
01/02	0	1	1	3	6	0	11
02/03	0	0	0	2	7	2	11
03/04	0	0	2	0	6	0	8
04/05	0	1	1	0	3	0	5
05/06	0	3	0	0	8	0	11
06/07	0	1	0	2	5	0	8
07/08	0	1	0	3	7	1	12
08/09	2	6	0	2	7	0	17
09/10	0	0	0	1	3	0	4
10/11	0	2	0	1	5	0	8
Average First five years		3.8	1.4	5.6	11		22
Average Last ten years		1.5	0.4	1.4	5.7		10

2.6.4 Absolute risk of a carbon monoxide incident by appliance type

This quantifies the overall risk associated with different appliance types and determines whether it falls within generally accepted safety guidelines. It requires a reliable estimate of the appliance population nationwide. Such reliable appliance population estimates are only available for boilers and cookers and therefore absolute risks have only been calculated for these categories of appliance.

2.6.4.1 Absolute risk of a carbon monoxide incident involving boilers

For 2010/11, the estimated number of people with gas central heating in Great Britain was 49.9 million[23]. Using 49.9 million as the number of people at risk from gas central heating an estimate of the range of the absolute incident rate related to gas central heating has been derived (see Table 13). The higher estimate of risk assumes all unknown (unreported) appliances were central heating appliance and the lower estimate assumes none of these were central heating appliances.

Table 13 Incident data for central heating boilers

	July 1st 2010 to June 30th 2011		
	Incidents	Fatalities	Non-fatalities
Carbon monoxide incidents - including 7 incidents with unknown appliances which had no fatalities and 23 non-fatalities	32	5	66
Carbon monoxide incidents - excluding unknowns	25	5	43
	Incident rate	Fatality rate	Non-fatality rate
Per million people per year (assuming unknowns are not central heating related)	0.50	0.10	0.86
Per million people per year (assuming unknowns are central heating related)	0.64	0.10	1.32

The risk of a fatality associated with central heating appliances in Great Britain over the reporting year 2010/11 is less than the commonly accepted health and safety criterion of 1 fatality per million people at risk per year. More particularly it is equal to 1 fatality per 10 million people at risk per year (or 5 fatalities nationwide per year).

23 Great Britain population mid 2010 60.4 million (Section 4 Ref 5) of which 86.1% (table 3.1. Section 4 Ref 3) are gas households and 96% of the latter have central heating (Section 4 Ref 8).

2.6.4.2 Absolute risk of a carbon monoxide incident involving cookers

The estimated gas hob and gas oven populations for GB are shown in Table 14.

Table 14 UK cooking appliance population estimates

	Source data DUKES[24]			Inferred populations		
	Electric ovens millions	Electric hobs millions	Households millions	Gas hob & oven millions	Electric hob & oven millions	Gas hob & electric oven millions
UK households	16.6	12	26.6	10.0	12.0	4.6
GB households			25.2[25]	9.5	11.4	4.4
GB population			60.5	22.7	27.3	10.5

Table 14 assumes:

1) Homes without an electric oven have a gas hob and oven.
2) Home with an electric oven have an electric hob.
3) Percentage ownership of cooking appliances is the same in the UK as in Great Britain.

Table 15 Incident data for cooking appliances

	July 1st 2009 to June 30th 2010		
	Incidents	Fatalities	Non-fatalities
Gas cooker or separate hob			
Carbon monoxide related incidents including 7 incidents with unknown appliances which had no fatalities and 23 non-fatalities	19	2	41
Carbon monoxide related incidents excluding unknown	12	2	18
	Incident rate	Fatality rate	Non-fatality rate
Gas cooker or separate hob population base			
Per million people per year (assuming unknowns are not cooking related)	0.15	0.06	0.54
Per million people per year (assuming unknowns are cooking related)	0.24	0.06	1.24
Gas cooker population base			
Per million people per year (assuming unknowns are not cooking related)	0.22	0.07	1.72
Per million people per year (assuming unknowns are cooking related)	0.35	0.07	3.92

The risk of an incident, fatality or non-fatality involving a cooker is shown in Table 15. A range of risk is shown because of the differing assumptions made about the incident data concerning unknown appliances.

The risk of a fatality associated with cooking appliances in Great Britain over the reporting year 2010/11 is less than the commonly accepted health and safety criterion of 1 fatality per million people at risk per year. More particularly, it is even less than 1 fatality per 10 million people at risk per year.

24 Table 3.11. Section 4 Ref 9.
25 Great Britain Mid 2010 Population (Section 4 Ref 5) divided by 2.4 (Section 4 Ref 4). This estimate of the population is marginally less than last year's figure of 25.3 million and is not a real reflection in a small drop in the number of households but due to the limited accuracy of all sample surveys.

2.6.5 Discussion

The total number of fatalities due to accidental carbon monoxide poisoning associated with natural gas use has declined from an average of 22 to 10 per year over the last 15 years, the turning point being around the start of the millennium. The average number of fatalities associated with central heating appliances has declined by 6, space heaters by 4 and cookers by 2 (see Table 12) over the last ten years. This year's figures by appliance type are average for this period. The decrease in fatalities evident over the past 15 years has been reflected in each of the most populous appliance types (central heating, cookers and space heaters).

Absolute fatality rates and incident rates this year associated with cookers have been slightly lower than those associated with central heating appliances. Risk rates for fatalities involving each appliance type are at or below one tenth of the generally accepted risk criteria of 1 fatality per million-people years.

Last year, the figures showed that older boilers (more than 20 years old) were more likely to be involved in an incident (nine were reported). However this year only one incident involved a boiler more than 20 years old for those boilers where the age was reported.

Data relating to boiler type revealed that back-boiler units pose between 4.2 and 4.6 times the risk of other boiler types. This is not unexpected given that back-boilers are open-flued appliances which tend to pose more of a risk than room-sealed appliances. Furthermore back-boiler units comprise two appliances in one (a fire in front of a boiler) and therefore present more of a risk than a single appliance.

There is little evidence to suggest that non-condensing boilers pose more of a risk than condensing boilers, despite the latter being predominantly room sealed appliances.

Warm-air units featured in four incidents which is double last year's figure. It is recommended that a reliable estimate of the number installed nationwide is obtained to see if these appliances pose more or less risk than boilers and hence whether or not specific safety guidance to users or operatives should be provided.

For the fourth year running, there are some reported incidents involving condensing boilers (all room-sealed). This is considered to be a reflection of the rapid increase in the condensing boiler market (now over 99% of sales and over a quarter of the general boiler population in 2009) due to energy efficiency legislation introduced in April 2005. The condensing boiler incidents were not fatal with fatal incidents being restricted to older boilers (see Figure 15).

2.7 Individual appliance types and models

Detailed information about the incident appliances is presented below as it was stated on the DIDR form. This included the manufacturer's name and model which has been included for the record. No significance can be attributed to models or manufacturers without relating this to the numbers of such appliances installed nationwide. For example, the most frequently occurring manufacturer's name featured in the incident reports may be there simply because it is the most common manufacturer in the general population or, alternatively, that the incident may have had nothing to do with the design or performance of the appliance, but a consequence of poor installation, maintenance or servicing practice.

2.7.1 Fatal incidents

2.7.1.1 Boilers

Five fatalities were linked to boilers. Two were double fatalities. Details on the other are awaited.

- **Back-boiler units (BBU)**

One double fatality. Thorn - Housewarmer

- **Regular boilers (non-condensing)**

One double fatality. Potterton - Netaheat

- **Combi-boilers (non-condensing)**

No fatal incidents

- **Condensing combi-boilers**

No fatal incidents

- **Condensing regular boilers**

No fatal incidents

2.7.1.2 Space heaters

One fatality. Valor - Heartbeat fire

2.7.1.3 Cooking appliances

Two fatalities were linked to cooking appliances. One fatality involved a Cannon Warwick Cooker. Details for the other were not supplied.

2.7.2 Non-fatal incidents

The following sub-sections describe those appliances involved in non fatal incidents that were fully investigated.

2.7.2.1 Central heating appliances

These were involved in 20 incidents.

- **Back boiler units (BBU)**

Myson - Housewarmer Epic 2 fire front
Baxi - VP firefront 552
Glow-worm – boiler Galaxie fire
Glow-worm - BBU 56

- **Condensing regular boilers**

Glow-worm - Swiftflo

Glow-worm - no more details supplied

- **Condensing combi-boilers**

Worcester - Green Star 25 CDI

- **Combi-boilers (non-condensing)**

Vokera - 24e

BKL Simal - Heat Master DFF 24

Worcester - Greenstar HE

- **Regular boilers (non-condensing)**

Glow-worm - Flexicom30 CX

Potterton - Kingfisher Mk II CF50

Glow-worm - Space Saver 50R

Glow-worm - Space Saver

BROAG - Remeha Selecta

Potterton - Suprima ABG0631

2.7.2.2 Warm air heaters (four incidents – one incident no appliance details)

Johnson & Starley - JT 19-25 MK2

Halstead - Heat Master GWA 46W

Heatinaire - 40656

2.7.2.3 Space heaters

Five incidents involved space heaters. Only three are detailed.

Focal Point - Mayon flueless catalytic gas fire

Cannon - Strata

Valor - Dream

2.7.2.4 Cooker/boiler

No incidents

2.7.2.5 Cooking appliances

9 incidents involved cookers and one a built-in hob. Details were not supplied for 5.

Leisure - Laureat cooker

Flavell - Finesse cooker

Glynwed - Leisure Victoriana El

Belling - Cooker

2.8 Appliance installation details - Section 6 of DIDR

Table 16 provides information relating to the person reported to have installed the appliance involved in an incident and whether the appliance installation was to standard.

Table 16 Appliance installation details

	To current standards	To standards current at time of installation	Not to any appropriate standards	Unsure/ don't know	Total
Registered	2	1	1	0	4
Non-registered	0	0	0	0	0
DIY	0	0	0	0	0
Unknown	3	4	14	25	46
Total	**5**	**5**	**15**	**7**	**50**

The vast majority of appliances had unknown installers (46 out 50) so an analysis of those carrying out the appliance installation is inappropriate.

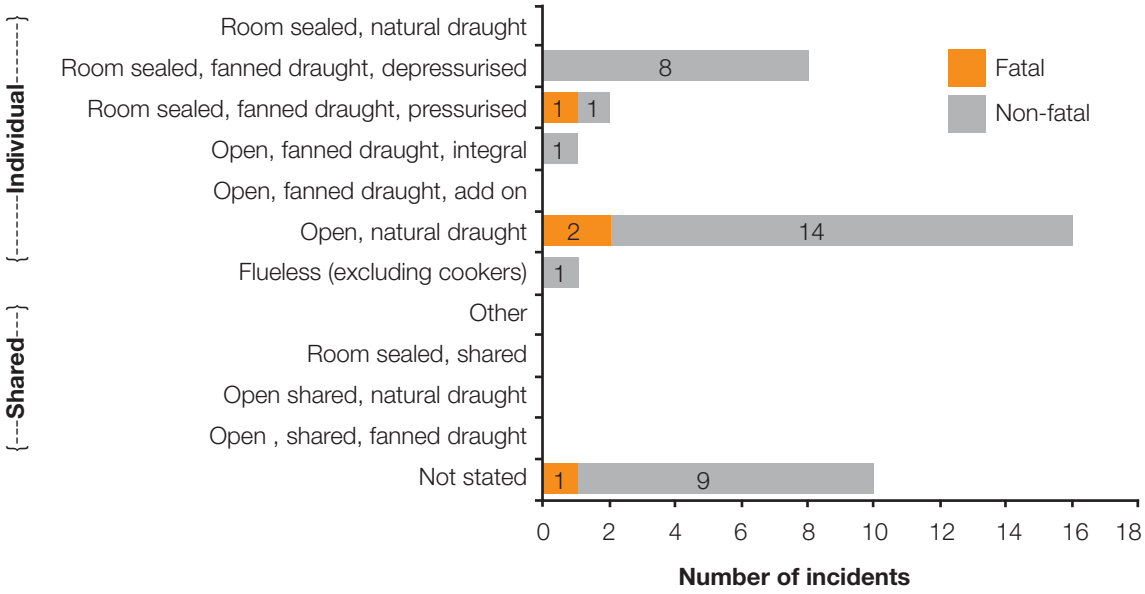
One registered operative carried out an installation that was not to standard. This was a boiler installed in 2007 and which was reported as having "no cooling compartment ventilation".

2.9 Flue details – Section 7 of DIDR

A breakdown of 28 (out of 39) incidents by flue type involved is shown in Figure 20. Most incidents involved open flues (11 incidents for room-sealed flues, 16 for open flues and 1 for a flueless appliance). One fatal incident involved a room-sealed appliance and 2 fatal incidents involved an appliance with an open flue.

The proportion of incidents involving all appliances with open flues has increased from 55% to 63% from 2009/10 to 2010/11.

Figure 20 Incidents by flue type



Population data on open-flued and room-sealed boilers in previous annual reports refers to a survey in 2005. In May 2005[26] 19% of boilers had open flues. Since then the number of boilers with open flues has gradually declined as they have been replaced by newer room-sealed boilers making this an upper estimate of the population of room-sealed boilers and hence resulting in a lower estimate of the relative risk associated with open-flued boilers compared to room-sealed boilers.

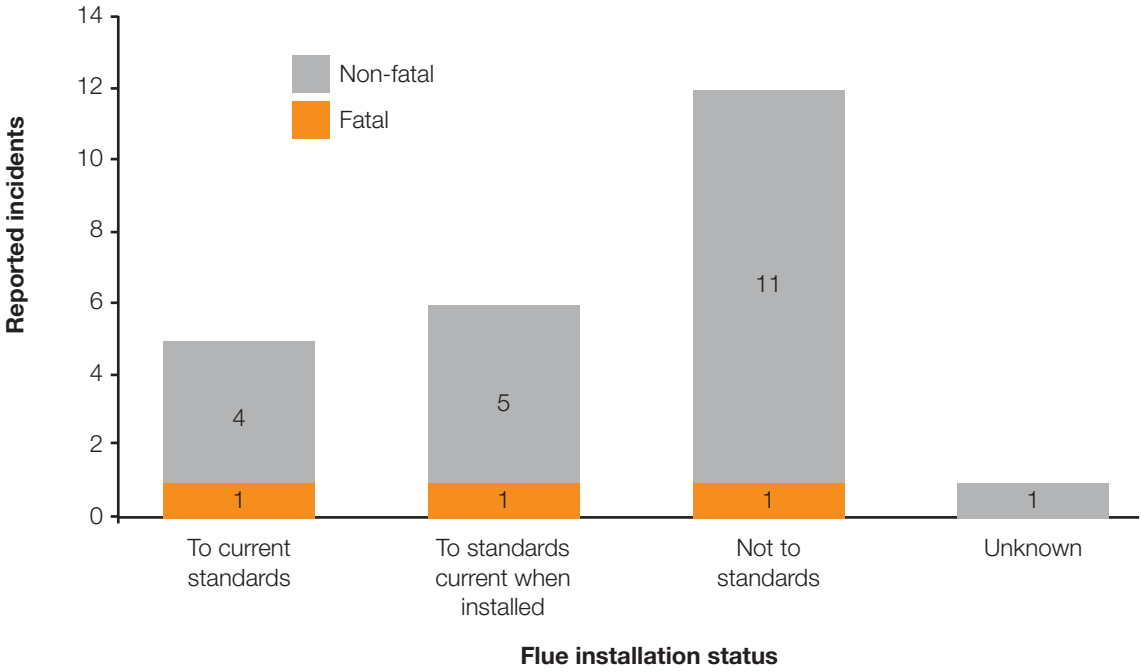
Table 17 shows the numbers of boiler incidents reported where the flue status was specified (22) and the expected number based upon the estimated boiler population in May 2005 assuming equal risk by flue type.

Table 17 Reported and expected incident numbers for boilers by flue type

Boiler flue	Reported number	Expected number
Open flue	13	4
Room-sealed	9	18

Assuming open-flued and room-sealed boilers are equally likely to be involved in an incident, the probability of 13 or more incidents occurring by chance is very small (less than 0.01%). It is therefore concluded that boilers with open flues expose occupants to a higher risk of a carbon monoxide incident, fatal or non-fatal, that is at least 6 times that of room-sealed appliances. This is higher than the figure reported last year which was 4.6 times.

Figure 21 Incidents by flue standards



An analysis of the 24 incidents with known flue installation status is shown in Figure 21 and indicates that 50% had not been installed to standard (either current or existing at installation), which is a sizeable proportion. This compares with a corresponding proportion of 40% not installed to standard in 2009/10, so the issue is worthy of comment.

26 Section 4 Ref 10

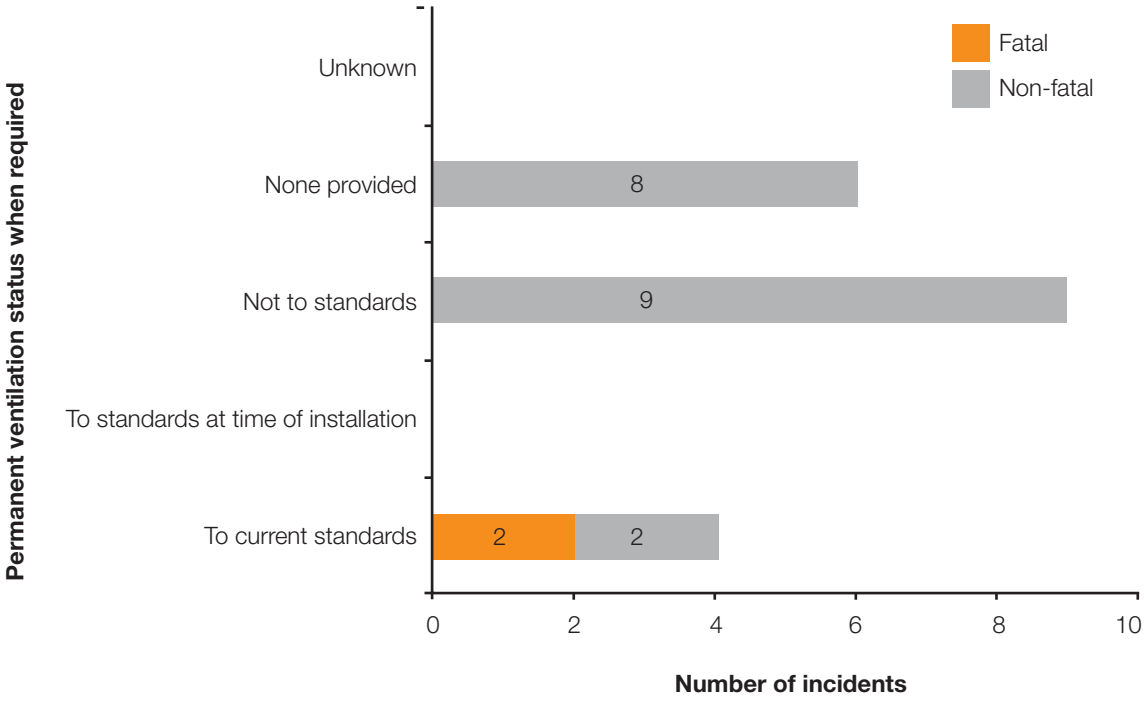
One fatal incident was linked to flues that had not been installed to any standard (gas fire connection to the chimney not sealed properly), one to a flue that had been installed to current standards (flue blockage due to lack of servicing sited as main cause) and one to standards existing at the time of installations (poor servicing cited as the main cause).

2.10 Permanent ventilation – Section 8 of DIDR

Just over a half of the completed DIDR forms (27 out of 50) specified whether permanent room ventilation was required or not. 16 out of the 27 reports stated that room ventilation was required. The breakdown of DIDRs where it was stated that ventilation was required is summarised in Figure 22.

When permanent ventilation was provided it was generally substandard. 20 incidents that indicated room ventilation was required had inadequate provision and these included two fatal incidents.

Figure 22 Incidents by reported ventilation condition



Where ventilation was provided, there were five incident sites at which this was found to be obstructed. A breakdown of those incident sites where partially or totally obstructed vents were reported is given in Table 18.

Table 18 Incidents reported with obstructed ventilation

Number of incidents with:	
Vents intentionally obstructed	2
Vents unintentionally obstructed	3

2.11 Safety devices - Section 9 of DIDR

The categories of safety device specified on the DIDR forms are carbon monoxide detectors (chemical spot or battery/mains powered alarm type), downdraught sensors and anti-vitiation devices. Safety devices were reported at 13 sites.

Carbon monoxide electrical alarms were found to have been installed at 11 of the incident sites. Five were found not to be working. Two of the alarms that were not working were reported as “out of date” or “battery out of date”.

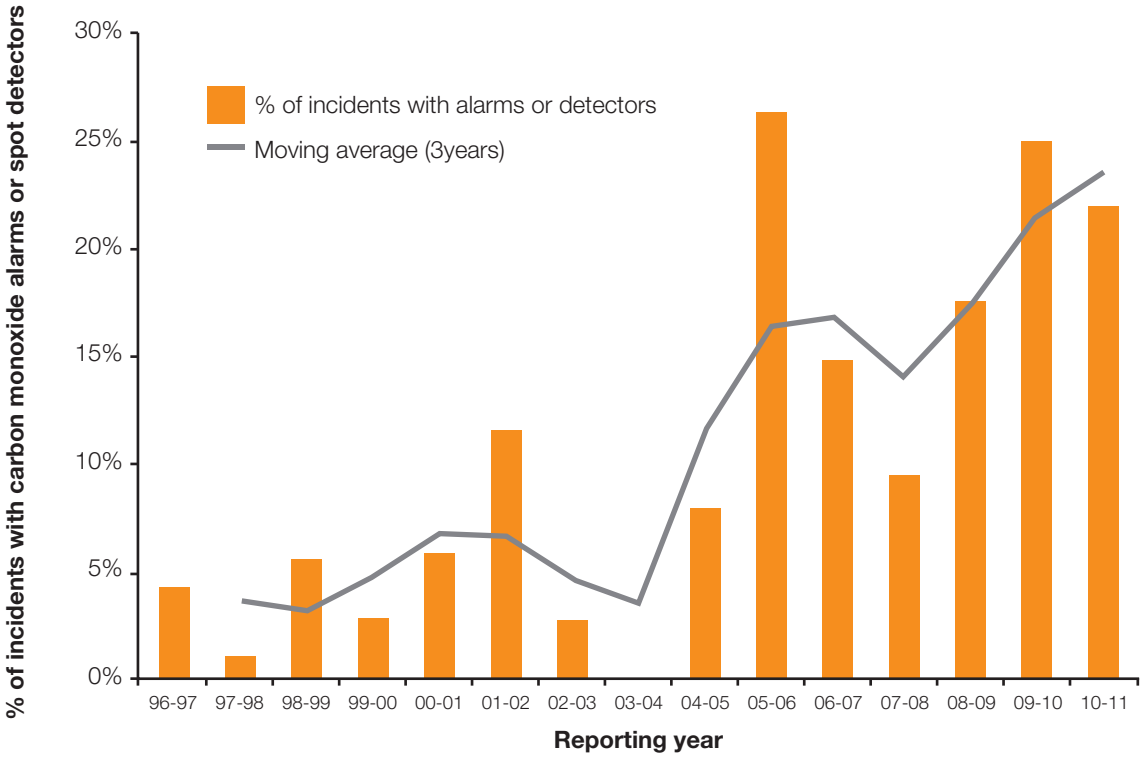
Four of the alarms were not installed in the same room as the incident appliance and five were located in the same room as the affected occupant.

Also, it was reported by investigators that during four incidents the carbon monoxide alarm had sounded.

2 anti-vitiation devices were also identified on incident appliances although no downdraught sensors were reported.

Figure 23 shows the proportion of incidents where a carbon monoxide alarm or chemical spot detector was reported, since 1996. Prior to 2004/5 the average number of incidents where alarms or detectors were installed was about 5% and this has risen to over 20% by 2010/11. The graph shows a three-year moving average centred on the middle year. The moving average for 2010/11 is the average of 2009/10 and 2010/11 values.

Figure 23 Percentage of incidents with carbon monoxide alarms or detectors



2.11.1 Discussion

The figure of 22% of incident sites where carbon monoxide detectors were found was similar to last year (25%).

It is difficult to judge the significance of the increasing percentage in Figure 23 in the absence of population data on detectors.

There is evidence that carbon monoxide alarms are helping to reduce the number of serious incidents. During 2009/10, five cases were brought to the attention of British Gas by the emergency service provider, which were subsequently identified as not meeting the RIDDOR reportable incident criteria because it appeared that the occupants had been alerted before any injury was sustained. Three more similar cases were brought to the attention of British Gas in 2010/11.

2.12 On-site checks - Section 10 of DIDR

The on-site investigation of an incident involves the investigator making a number of fundamental observations and carrying out specific checks and measurements. The results of these are reported in Section 10 of the DIDR form and are broken down by category in Figure 24 and Table 19. There was a wide range of faults but it should be remembered that these have not necessarily caused the incident.

The specific faults which were considered to have contributed to each incident are discussed in Section 2.14.

Figure 24 Reported faults by type

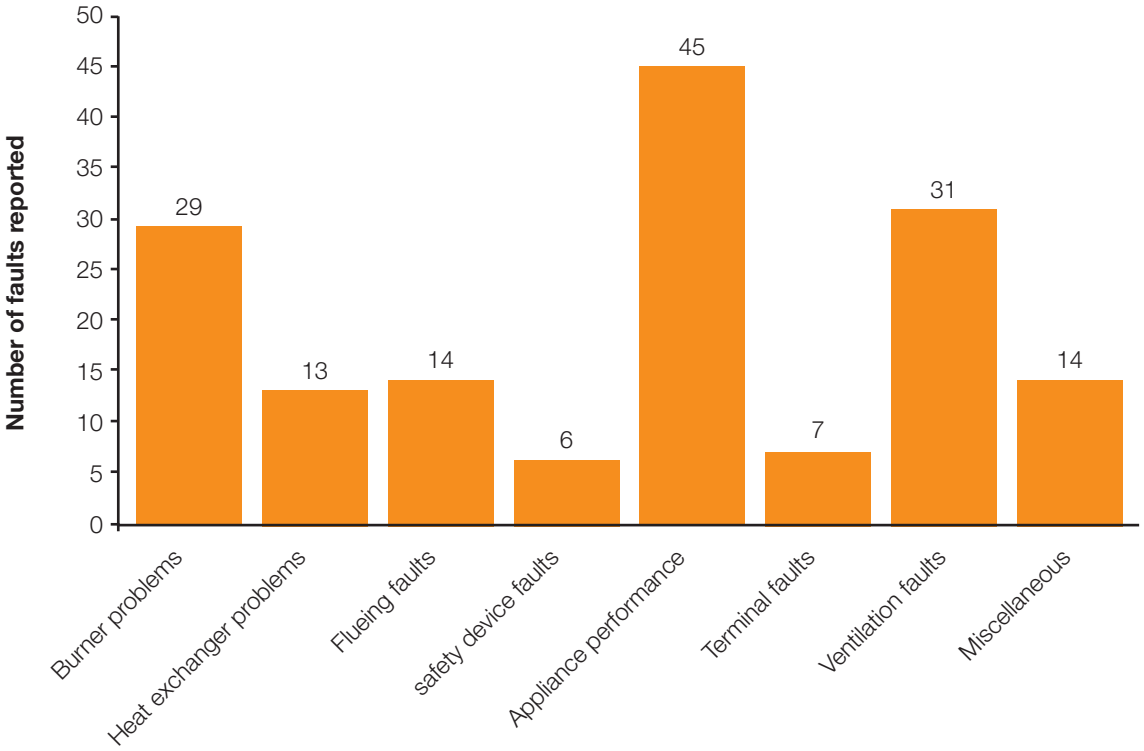


Table 19 Incident appliance faults

Fault group	Number of faults	Fault group	Number of faults
Burner		Appliance performance	
Corrosion	3	High CO/CO2 ratio	13
Defective flame picture	5	Failed spillage test	5
Linting	9	Overrated	3
Over-pressure	5	Underrated	4
Under-pressure	2	Signs of spillage – inside or outside	20
Other	5	Terminal	
Flue		Down draught	1
Blockage	3	Bad siting	3
Corrosion	2	Unapproved design	0
Flue not to any standard	0	Other	3
Installation fault	4	Ventilation	
Other	5	Air vent/vents ineffective	8
Heat exchanger		Air vents obstructed - intentionally	3
Blockage - shale	1	Air vents obstructed - unintentionally	4
Blockage - soot	5	Compartment not to any standards	1
Cracked	2	No permanent ventilation provided	6
Other	5	Ventilation was not to any standard	9
Safety device		Miscellaneous	
CO inoperable alarm†	5	Local topography	1
Failed down draught detector	0	Weather	13
Failed vitiation device	1		

Note to Table 19:

The numbers quoted are the numbers of appliances found with the fault listed.

† Carbon monoxide alarm could be inoperable as it had no battery or did not function when tested using either a portable carbon monoxide kit or was tested off site.

2.13 Incident appliance history - Section 11 and 12 of DIDR

Service history details were reported for 33 incidents and details are given in Table 20.

Four fatalities involved an appliance on which there was no service contract. The status of the service contract for the remaining four fatalities was not reported.

Table 20 Details of service history

Service history status	Number of incidents	Number of fatalities	Number of non-fatalities
On a regular service contract	10	0	15
Not on a regular service contract	14	4	30
Unknown if on a regular service contract	9	2	19
Total where the service history was known (sum of three rows above)	33	6	64
Total reported incidents	50	8	101

The registration status of the gas operative who attended the installation prior to the incident is given in Table 21. A working visit is a visit other than the original installation.

Table 21 Details of last working visit

	Number reported	Number of fatalities	Number of non-fatalities
Non-registered operative	1	0	5
Registered operative	18	3	32
Unknown	14	3	27
Total for all incidents	50	8	101

Two incidents with three fatalities were reported as having the last working visit made by a registered operative. One of these involved a cooker that had been installed in the last six months by a registered operative and the fatality was caused by using the cooker for a prolonged period (probably as a heater) in a poorly ventilated room. The cause of the second incident, a double fatality, had nothing do with the visit of the registered operative as the user had tampered with the appliance.

Over half (18 out of 33) of the incidents reported the last working visit had been by a registered operative.

An analysis of the time period that elapsed between the last working visit and the incident is given in Table 22. Thirteen incidents were reported as having a working visit within a year of the incident and at least seven were by a registered operative.

One of the fatal incidents reported involved an operative making a working visit to the property less than 6 months prior to the incident. This was the fatal incident caused by using the cooker as a heater.

Warning notices classify a situation as immediately dangerous (ID), at risk (AR) and not to current standards (NCS)[27].

Warning notices had been left at two premises prior to an incident occurring. One was an “at risk” notice left 14 months prior to the incident and the other was left with a “do not use” label on the gas meter. The premises where the latter incident took place had been visited within the previous six months for a service and breakdown and this is presumably when the label had been left. Neither incident was fatal.

Like last year, when 2 incidents involved a previous visit by a non registered gas operative (out of 25 where the operative’s details were known), a non registered operative attended in advance of 1 incident in 2010/11 (out of 19).

27 The Gas Industry Unsafe Situations Procedure. Section 4 Ref 12.

Table 22 Interval between the last working visit and the incident

Time between the last working visit and the incident	Number of reported visits	Number of reported fatalities	Number of reported non-fatalities
Less than 6 months	7	1	17
6 months to 1 year	6	0	14
1 year to 2 years	2	0	4
More than 2 years	1	2	0
Unknown	15	3	25
Total with appliance history	31	6	60
Total of all incidents	50	8	101

2.13.1 Discussion

It would be expected that registered operatives visiting a property in the 12 months prior to an incident (at least 24 reported during 2009/10 and at least 7 in 2010/11) would be leaving an appliance working safely and operating satisfactorily. If all due care was taken, appliance failure in the period soon afterwards would typically be a result of misuse or particularly extreme adverse weather conditions.

It would be reasonable to expect that an appliance which had been **serviced** would be safe for a year after a working visit by an operative. However, for a **non-service** related visit or a service visit that was not conducted in compliance with the appliance manufacturer's instructions, the time for which the installation would be expected to work safely and operate satisfactorily cannot be guaranteed.

The nature of the 13 incidents where a working visit was made by a gas operative during the previous twelve months is not known but the number compares with 24 in 2009/10.

Two warning notices were left and appeared to have been ignored or not understood by the occupant. Fortunately no fatalities were involved. However, it does support last year's finding that the effectiveness of the warning notice classification system specified in the Gas Industry Unsafe Situations Procedure should be challenged.

The issue of non-registered gas operatives attending properties remains a concern. There have been only 3 years since 1996 where non-registered operatives attending a property prior to an incident have failed to feature in the annual carbon monoxide incident statistics.

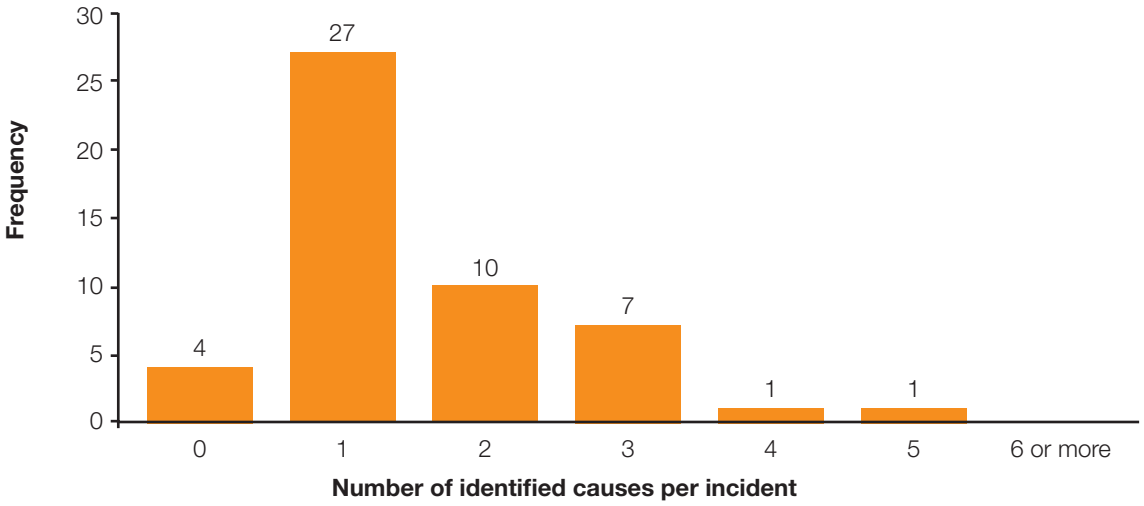
2.14 Incident cause or causes - Section 13 of DIDR

Details of the cause or causes of reported incidents are summarised in Figures 25 and 26. It should be noted that these causes are different from the general faults discussed in Section 2.12.

Figure 25 shows the distribution by the number of causes reported per incident. For example, a single cause was recorded for 28 incidents whilst a further 10 had 2 causes specified. "Zero causes" means there had been no cause specified or one had yet to be established.

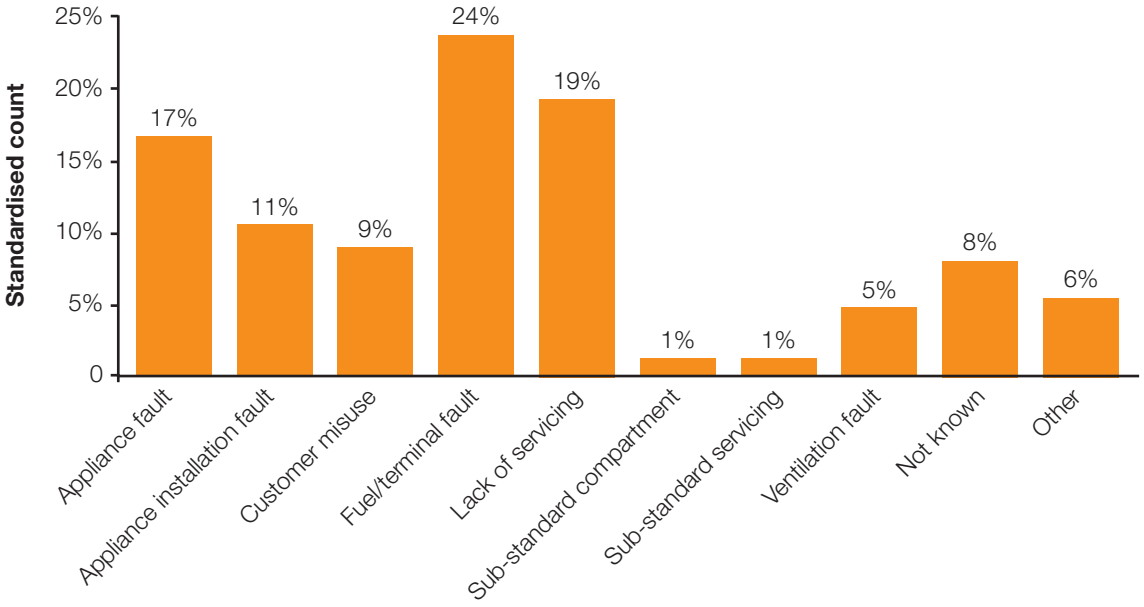
Experience has tended to suggest that incidents occur when a number of events conspire to produce carbon monoxide and lead to its discharge into a property. This year like last year, a sizeable number of incidents were reported as having a single cause (27 out 50). The most frequent single cause stated was flue/terminal fault, followed by appliance fault and lack of servicing.

Figure 25 Distribution of the number of stated causes



In Figure 26 the counts have been standardised by dividing the counts by the number of established causes per incident and are expressed as a percentage of the total count (50). For example, if there were three causes stated for one incident, each of the three causes would be allocated a third of a count.

Figure 26 Reported causes



The obstruction of ventilators is discussed in Section 2.10. Weather, as a reported cause, is usually associated with high winds but could also reflect low temperatures.

If all causes were equally likely, the contribution score for each cause group would be 10%, so groups with a contribution score above 10% constitute a higher contribution than average.

Flue/terminal fault was the most common cause specified by investigators with an equivalent count specified in nearly a quarter of the incidents (24%), followed by lack of servicing (19%), appliance fault (17%) and appliance installation fault (11%). The other causes were less frequency specified.

Sub-standard servicing is considerably lower this year only contributing to the equivalent of 1 in 100 incidents. In 2009/10 it scored 8%. Lack of servicing remains consistently high as a reported cause.

This year appliance faults included a cooker producing high levels of carbon monoxide due to poor combustion, defective grills, a defective catalytic flueless fire and a broken clip on the combustion chamber of a combi-boiler.

Reports of customer misuse of an appliance (9%) as the cause of an incident all relate to cookers and were up slightly compared to 2009/10 (7%) but down compared to 2008/9 (13%). Customer misuse in 2010/11 included using the cooker for a prolonged period as a heater (fatal), using grossly oversized pans on hobs and using a damaged cooker with the inner oven door removed.

Three incidents occurred after roofing work had been carried out on the properties.

Sub-standard compartments reportedly causing an incident had the contributory score of 1%. Last year it also scored 1% and although the gas industry has known for some time that sub-standard installations in compartments can cause a more rapid generation and spread of carbon monoxide around a property than those not in a compartment, this has rarely been specified by investigators as the cause of an incident for at least three years.

3 Conclusions and recommendations

i) Fatalities as a result of carbon monoxide incidents tend to be quoted in the media and numbers often vary widely. Incident numbers are considered to be the preferred indicator for assessing how successfully the issue of accidental carbon monoxide exposure is being dealt with by the industry and it is recommended that efforts should be made to promote the use of consistent and accurate information.

ii) The level of risk associated with warm air units and space heaters being involved in a carbon monoxide incident would be estimated more reliably if the nationwide populations of these appliance types could be updated and this is recommended.

iii) The report identifies a disproportionately high number of incidents involving appliance installations that are open-flued as opposed to those which are room-sealed. It is recommended this situation be monitored in order that any policy making decisions relating to the safe performance of different appliance installation types can be made with suitable supporting evidence.

iv) This year, back-boiler units, which tend to be open-flued, have been involved in a significant number of incidents. The importance of servicing this category of installation at the manufacturer's recommended intervals should therefore be emphasised.

v) The causes of incidents involving condensing boilers, as opposed to non-condensing boilers, have tended to be associated with poor installation and third party interference rather than appliance design.

vi) The prevalence and performance of carbon monoxide alarms at incident locations has been reported. Some alarms:

- sounded although an incident was still reported
- alerted occupants to a discharge of carbon monoxide
- were found not to be working

vii) It is recommended that consideration be given to updating the DIDR form in order to gather more information on how effectively an alarm has been protecting the domestic gas users. This could extend to checking each carbon monoxide alarm's performance following an incident.

viii) Given it is the gas supplier's legal obligation to organise a full investigation of a reportable carbon monoxide incident, every effort should be made to ensure this takes place so that sufficient incident information is made available to identify any incident trends/patterns on behalf of the gas industry. Where it proves not to be feasible to carry out a full investigation, every effort should be made to obtain as much information as possible. One way of achieving this could be for the incident co ordinators to run through the DIDR form with the gas user or another person who had been present and involved in the incident.

ix) The greater level of risk for a solid fuel appliance being involved in a carbon monoxide incident compared to a gas appliance strongly suggests that the investigation of incidents and the collation of detailed incident information should be enforced and regulated in this energy sector. Refer to Appendix D for more details on solid fuel and oil incidents.

4 References

1. Hayton J, Moore M, Pool G and Moseley J, A review of carbon monoxide incident information, for 2008/9, produced from the full investigation of incidents which involved piped natural gas and LPG, within Great Britain, CORGI Trust, 2009

2. http://www.demographicsonline.com, Experian, October, 2011

3. English Housing Survey, 2009, Department for Communities and Local Government, July 2011

4. Households and families, Social Trends 41, Office of National Statistics, 2011

5. Mid-2010 Population Estimates: Great Britain; estimated resident population by single year of age and sex, Office of National Statistics, June 2011

6. Carbon Monoxide Trends Report, 1996 to 2010, www.gas-safety-trust.org.uk

7. English House Condition Survey 2007 Annual Report, Communities and Local Government, September, 2009

8. Shorrock Les et al, Domestic Fact file 2008, BRE.

9. Energy Consumption in the UK, Domestic data tables, 2010 Update, Office of National Statistics, July 2010

10. Crowther M, Forrester H and Wood M, Assessment of the size and composition of the UK gas appliance population. DTI. GAC3407, 2005.

11. The Gas Industry Unsafe Situations Procedure, Edition 6, Gas Safe Register, October 2009.

12. Carbon Monoxide Trends Report – 1996 to 2010, Gas Safety Trust, 2011

Appendix A: LPG incident information received via DIDR forms

Two LPG incidents were reported to Downstream Gas during the 2010/11 reporting period. Subsequently one of these was confirmed as a solid fuel incident following the inquest and details of this are featured in Appendix D.

One fatal incident occurred in the M8 Manchester postal area on 3rd October 2010. A 19 year old female was fatally poisoned by carbon monoxide produced by a room heater in a mobile caravan. The appliance was fuelled by bottled LPG.

Appendix B: DIDR non-domestic incidents

Three non-domestic incidents were reported and all three involved natural gas.

The first incident occurred on the 27 June 2010 in the NW4 postal area of London caused by a second hand flueless pizza bread oven that was incorrectly installed and had insufficient ventilation provided. It involved eight people seated at a restaurant plus members of the Ambulance Service. There were no fatalities. The make of oven was Polka and it was situated in a commercial kitchen. The causes were reported to be faulty installation and lack of servicing.

The second incident occurred on 26 October 2010 in the Cardiff area. It resulted in a male being non-fatally injured and hospitalised for less than 24 hours. The appliance producing high levels of carbon monoxide was a floor-mounted central heating boiler installed in 2007 in the basement of a commercial premise. The carbon monoxide concentration measured during the investigation was 30 ppm in ten minutes adjacent to the boiler. The make and model of the appliance was an Ideal Concord 70 CXA. It was installed new by a registered installer to standards current in 2007 and was a natural draught appliance with an open flue which was also installed to standards current in 2007. The ventilation provision was not to standard. A registered operative visited the installation six months prior to the incident following the report of a break-down. The reported cause was incorrect adjustment of the gas valves and sub-standard servicing.

The third incident occurred on the 8 December 2010 in a commercial showroom in the Blackburn area. It resulted in two people being hospitalised for less than 24 hours. Tests for the concentration of COHb in their blood showed a level of 0% saturation. The appliance was producing high levels of carbon monoxide and was an indirect air heater, made by Sapragaz, model WHA, 160F. It was a second hand appliance, installed by a non-registered operative and was not installed to current standards. It had an incorrectly installed flue with no terminal fitted. It was a natural draught open flued appliance. A level of 213ppm of carbon monoxide was recorded at the showroom counter. The heat exchanger was identified as cracked. The reported cause was faulty appliance installation with flueing and termination deficiencies.

Appendix C: Past incidents previously unreported

None reported this year.

Appendix D: Carbon monoxide incidents related to the use of solid fuel and oil in the home

Since 1996, the focus for gathering carbon monoxide incident information from those who investigate has been on the gas industry in Great Britain. Mains natural gas and piped LPG represent the domestic energy supply for more than 20 million homes in Great Britain and legislation has ensured the responsibility for investigating a carbon monoxide incident resides with the gas supplier.

Whilst the gas industry has made significant inroads towards improving the situation for domestic gas users, and recognises there is still plenty to be done, moves have been made since 1st July 2011 towards agreeing a similar reporting system in the other major domestic energy sectors, oil and solid fuel.

The Gas Safety Trust has for many years published an annual report aimed at gathering information from the media on carbon monoxide incidents associated with gas, oil and solid fuel. Whilst the detail is limited, it nevertheless provides a useful analysis of where carbon monoxide incidents have been reported and in particular indicates where a cluster or hotspot of incidents has featured.

Regulation

The Gas Safety (Management) Regulations confer a responsibility upon the gas supplier to investigate a gas related carbon monoxide incident. The RIDDOR regulations define what constitutes an incident in terms of the severity of victims' injuries and appropriate treatment. These together mean the gas industry has significant regulation which essentially stems from the potential for gas to cause both fire and explosion damage.

Regulation in the oil and solid fuel sectors is not as great as in the gas industry even though it is recognised that carbon monoxide incidents associated with using these fuels in the home have been regularly reported for many years.

It was therefore agreed by The Gas Safety Trust and Downstream Gas that a reporting system be proposed for the oil and solid fuel energy sectors.

This was done for the solid fuel sector with the specific agreement assistance of HETAS, the solid fuel advisory service and competence assessor for operatives that install, commission, service and maintain appliances.

The counterpart of HETAS for the domestic oil energy sector is OFTEC, whose help was volunteered in identifying and co-ordinating a reporting system for carbon monoxide incidents involving oil.

Both HETAS and OFTEC have specialist investigators who were initially consulted on the way the format of the DIDR form used for reporting gas related carbon monoxide incidents should be modified for their energy sectors.

Implementation

Meetings were held between Downstream Gas and investigators at both OFTEC and HETAS in order to ensure the detailed assessments of carbon monoxide incidents were undertaken in such a way as to optimise data quality.

It was recognised from the outset when the reporting year 1st July 2010 to 30th June 2011 began that it would be challenging to expect the extent of information obtained from oil and solid fuel related incidents to be as wide as that gathered from gas related incidents. This would be both a consequence of the way investigators acclimatised to completing their reporting forms but also, and more importantly, it would be a result of there being relatively minimal legislative drivers compelling proper investigations to be carried out and for them to be the responsibility of a particular individual or organisation.

As the year went on, this latter factor became crucially important and HETAS were sometimes in the situation where no-one would pay for an investigation to be carried out. In order for there to be sufficient data to be obtained from such investigations one of the following needs to happen:

Either

- A fund is set up that investigators can draw upon as and when a 'reportable' incident occurs which can be assessed at the year end to determine whether its magnitude is affordable by one or more stakeholders

Or

- Regulations are introduced that confer responsibility upon the solid fuel and oil sectors to investigate 'reportable' carbon monoxide incidents in the way the Gas Safety (Management) Regulations do for the gas industry.

Reporting forms completed by HETAS

Three reports were received the details of which are given below. These all involved the use of manufactured smokeless mineral fuel.

i) One fatality was a 78 year old male. When he was found, the Parkray Consort dry room heater/stove with boiler had its door open. Using the appliance with the door open was identified as the cause of the incident. It occurred on the 19th December 2010 in the Nottingham area.

ii) A 36 year old woman, a 34 year old man and a boy aged 7 were hospitalised for less than 24 hours following an incident at 03.45hrs on 28th November 2010. The incident involved a Trianco Independent boiler which was found to be producing high levels of carbon monoxide that escaped into the property from a leaking chimney. The owner-occupied property was detached, had been built between 1964 and 1980 and was located in the Doncaster area.

iii) A 78 year old female and an 83 year old male were fatally injured on 28th November 2010 after the door of their Parkray dry room heater/stove was not closed properly. This occurred in a privately rented semi-detached property which had double glazing and a solid floor. The property was located in the Norwich area. This incident was initially thought to be due to a portable LPG heater. The subsequent inquest confirmed it was a solid fuel incident.

Reporting forms completed by OFTEC

Two reports were received from OFTEC investigators details of which are given below.

i) A double fatality was reported in Northern Ireland and is still being investigated by the HSE.

ii) Three non-fatal casualties not requiring hospital treatment resulted following an incident with a Fire Bird Rhino floor-standing oil-fired natural draught boiler in a privately rented detached house built in 1910 in the Edinburgh area. The exact cause of the incident is not known.

It should be remembered that currently the Gas Safety (Management) Regulations do not apply in Northern Ireland and hence no gas related incidents in the Province form part of this report. However, OFTEC does have offices in Northern Ireland and for the purposes of this report any oil related carbon monoxide incidents that have occurred in Northern Ireland have been included.

Downstream Gas and The Gas Safety Trust are presently working with representatives of HSE Northern Ireland (the health and safety regulator in NI) with a view to establishing a reporting process for carbon monoxide incidents for the three major domestic energy sectors. The domestic customer split in Northern Ireland is about 70% oil, 10% solid fuel and 20% gas.

The carbon monoxide incident data forms completed by HETAS and OFTEC investigators have provided the following in terms of headline casualty figures (both fatal and non-fatal). These should be viewed as minimum numbers given the lack of regulation to drive the reporting and full investigation of such incidents.

Table D1 Incident numbers reported by HETAS and OFTEC

	Great Britain households at risk, in 1000s	Great Britain population at risk, in millions	Fatalities, per year	Non-fatal injuries, per year	Incidents, per year
Oil	946[28]	2.3	0	3	1
Gas	21691	52.1	8	101	50
Solid fuel	180[29]	0.432	3	4	3

Table D2 Risk of an injury from a carbon monoxide incident in Great Britain

	Risk of a carbon monoxide incident per million people per year		
	Fatalities	Non-fatalities	Incidents
Oil	<0.44	1.32	0.44
Gas	0.154	1.94	0.96
Solid fuel	6.94	9.26	6.94

It should be noted that fatalities and the numbers of incidents recorded associated with solid fuel use are almost 7 times the generally accepted risk of 1 in a million people at risk per year. The risk of a fatal injury from carbon monoxide exposure in the home is 45 times that when using solid fuel compared to that when using mains natural gas.

Dedicated databases for detailed carbon monoxide incident information gathered since 1st July 2010 by incident investigators and submitted to Downstream Gas on the reporting forms developed with HETAS and OFTEC now exist and data collection continues.

28 Information supplied by OFTEC
29 Information supplied by HETAS

Appendix E: Carbon monoxide incident data for mains natural gas from 2010/11 compared with information from previous years

The information presented in this section allows a pictorial comparison to be made between this year and recent years related to mains natural gas use.

Figure E1 Incidents reported in 2010/11 compared with those reported annually since 2007/8

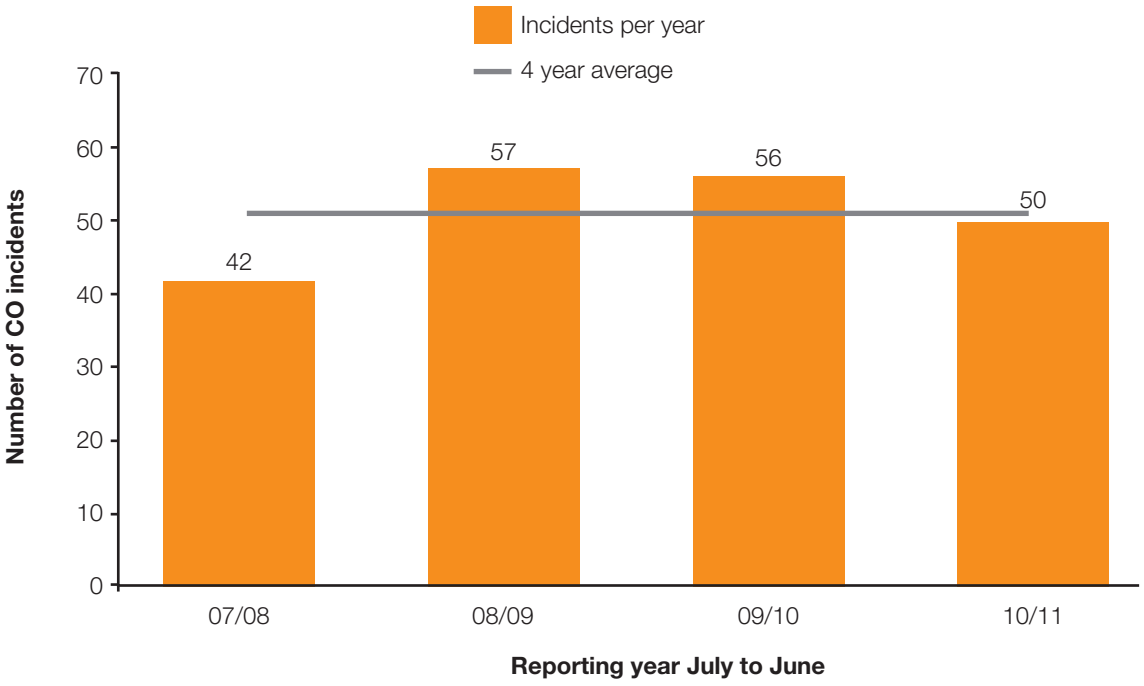


Figure E2 Injuries reported in 2010/11 compared with those reported annually since 2007/8

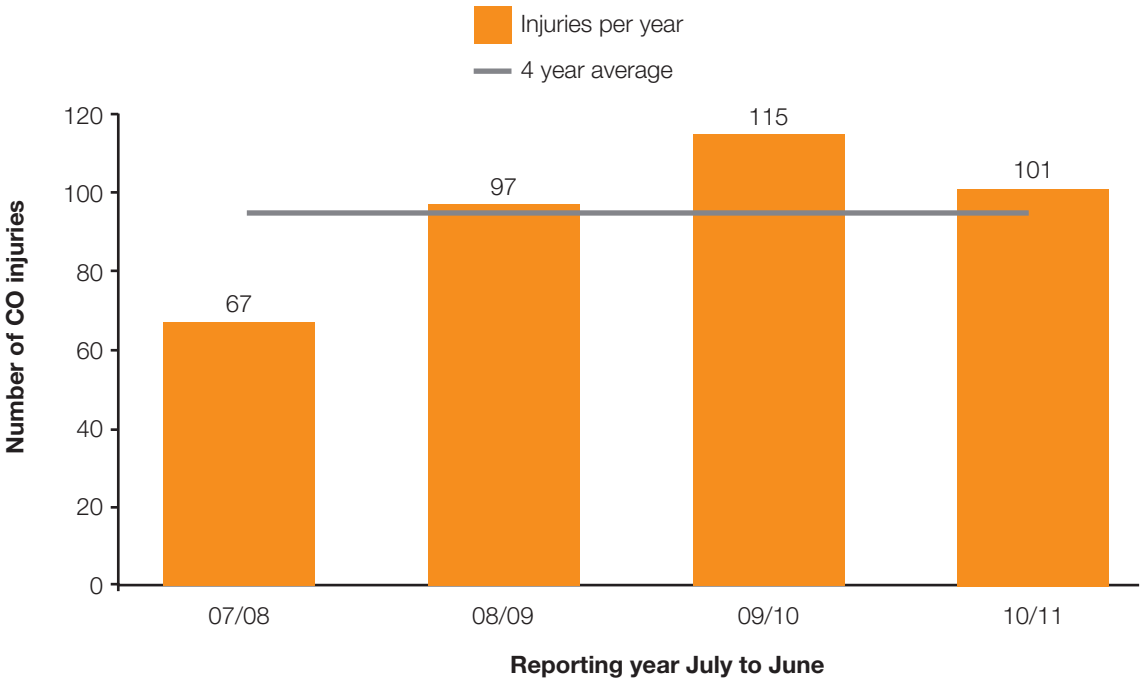


Figure E3 Fatalities reported in 2010/11 compared with those reported annually since 2007/8

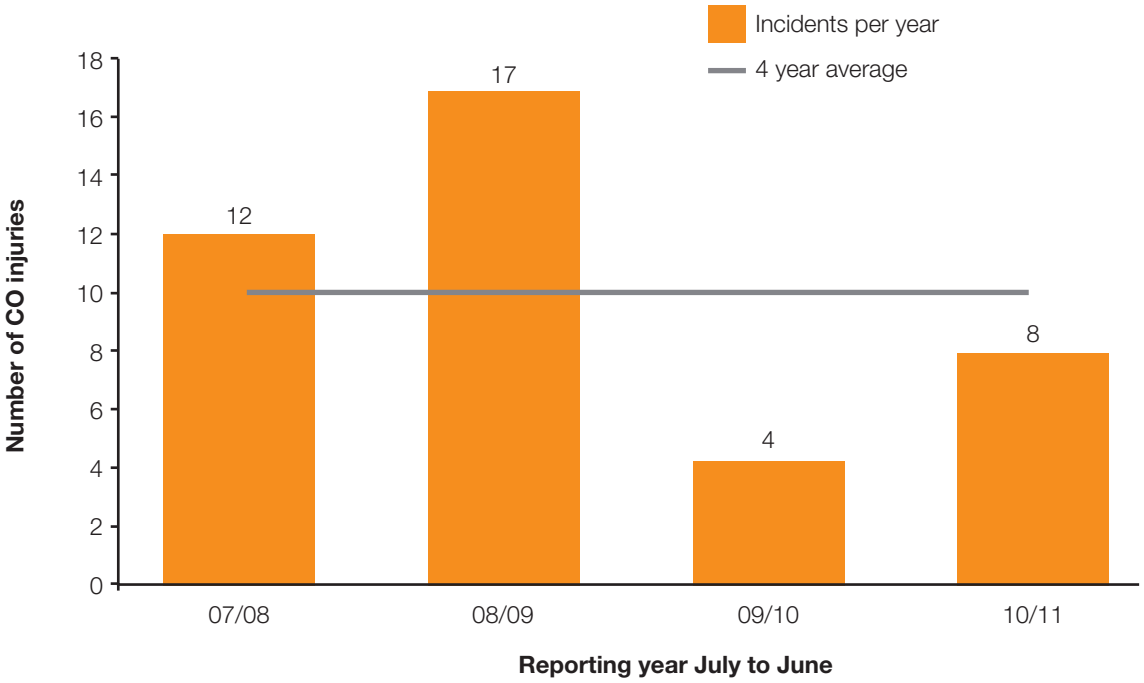
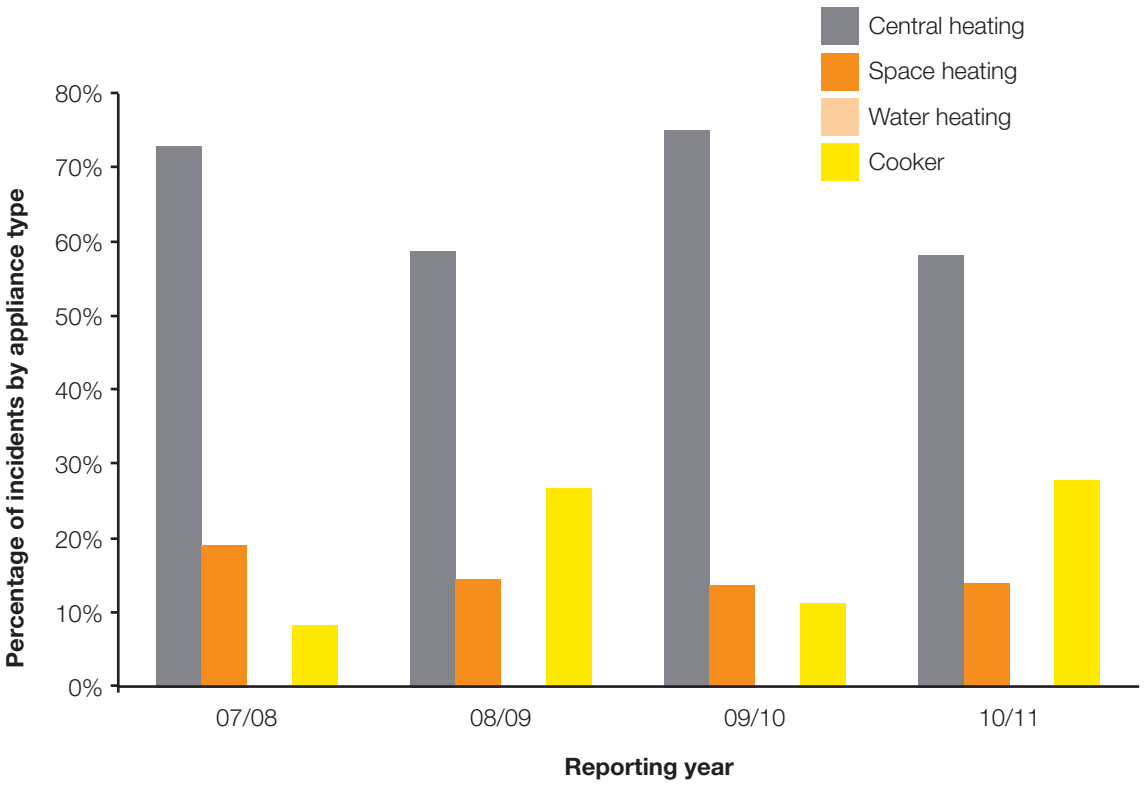


Figure E4 Incidents by appliance for 2010/11 compared with those reported annually since 2007/8



W www.gas-safety-trust.org.uk **T** 01256 548 020 **E** info@gstrust.org.uk

The Gas Safety Trust, Unit 7, Prisma Park, Berrington Way, Basingstoke, Hampshire, RG24 8GT, UK