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A review of carbon monoxide incident information for 2000/2001

Produced from the full investigation of incidents which had resulted from the use of piped natural gas and LPG within Great Britain

Prepared by
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RESEARCH REPORT 032

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Produced from the full investigation of incidents which had resulted from the use of piped natural gas and LPG within Great Britain

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This report has been written by Advantica Technology as a continuation of the work established during the Joint Industry Programme (JIP) Addressing Carbon Monoxide Issues, within the Incident Data project area. The aim of this work is to identify common causes of CO incidents related to appliance and system design, installation and maintenance. This information can then be used to further improve customer safety, to target expenditure on CO incident prevention and to identify further research work.

As part of the JIP project a national data collection scheme for piped natural gas and LPG Carbon Monoxide (CO) incidents, which occur within Great Britain, was established by Advantica Technology. This was with the support of the HSE and the gas industry. This report provides information collected via this national data collection scheme.

This is the fifth report of a series that are being published, starting with the 1996/97 report. It covers the financial reporting period 2000/01. The incidents are only described by postcode to ensure anonymity. During this period there were 95 domestic incidents reported. There were also two non-domestic incidents reported and five LPG incidents.

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CONTENTS

EXECUTIVE SUMMARY

This report has been written by Advantica Technology as a continuation of the work established during the Joint Industry Programme (JIP) Addressing Carbon Monoxide (CO) Issues, within the Incident Data project area. It covers the period 2000/01. The aim of this work is to identify common causes of CO incidents related to appliance and system design, installation and maintenance. This information can then be used to further improve customer safety, to target expenditure on CO incident prevention and to identify further research work.

As part of the JIP project a national data collection scheme for piped natural gas and LPG CO incidents, which occur within Great Britain, was established by Advantica Technology. This was with the support of the HSE and the gas industry. This report provides information collected via this national data collection scheme and analysed by Advantica Technology. Historical data has also been used within the report, from previously unpublished internal company reports, to show incident trends.

This is the fifth report of a series that are being published, starting with the 1996/97 report. It covers the financial reporting period of 2000/01. The incidents are only described by postcode to ensure anonymity. During this period there were 95 domestic incidents reported. There were also two non-domestic incidents reported and five LPG incidents.

The results of this report are summarised below: -

The number of domestic related CO poisoning deaths reported, at 16 during 2000/01, was the lowest recorded since 1993/94.

The over-all FPPY figure of 0.35×10^{-6} is within, what would normally be considered as, the "broadly accepted region" of HSE's criteria for the tolerability of risk. However societal concerns over gas safety override averaged numerical considerations.

There were no appliance types that were above the HSE's criteria for the tolerability of risk.

There was an above average risk of a CO incident in tenanted accommodation that was privately owned.

The most common room locations for casualties were in the bedroom and the living room/lounge.

The majority of all CO incidents involved open flued, individual, natural draught appliances.

Central heating appliances were responsible for the majority of fatal and non-fatal casualties.

The most common incident causes were a lack of servicing and flue/terminal faults.

Flueing and ventilation faults were common in many domestic incidents.

There were 5 LPG and 2 non-domestic incidents reported during 2000/01.

1 INTRODUCTION

This report covers accidental CO poisoning incidents resulting from the use of piped natural gas for the period 1st April 2000 to 31st March 2001. Data for incidents up to 1994/95 come from Advantica's own incident recording system. Following the restructuring of British Gas, insufficient information was collected to enable the statistics for 1995/96 to be calculated. From 1996/97 the information is obtained from incident reports and investigation forms completed on behalf of gas suppliers. If any additional reports should be received after publication of this report, they will be included within updated annual statistical tables in future reports.

Information for this report comes via the Downstream Incident Data Report (DIDR) - Form 551/7. Tables and plots are given of actual fatalities and incidents and also plots relating to the risk associated when using gas appliances expressed in terms of fatalities per person per year (FPPY), as incidents per person per year (IPPY) and as casualties per person per year (CPPY). The definitions and use of FPPY, IPPY and CPPY values are described in Appendix A. Fatality, casualty and incident trend data are presented within this report for incidents that occurred from 1993/94 to 2000/01. Appendix B gives details of each of the CO poisoning incidents for 2000/01.

Domestic incidents are covered in the main part of the report with LPG incidents and non-domestic incidents reported in Appendix C and D, respectively. Suspected intentional incidents have not been included in the analysis.

Some inconsistencies may appear in some parts of the report because all the required information may not have been completed on the DIDR forms. For example in Table 1 the numbers of casualties, by classification code, differs from the total number of non-fatal casualties reported in the total for Table 1. Some information was completed as "unknown" or "other" and in some instances the tick box was not completed (field empty).

The order used in this report follows the layout used in the DIDR - Form 551/7. Included on the DIDR form are 3 sections related to the installation of the following:-

- incident appliance
- flue
- permanent ventilation

Each of the three items are dealt with separately on the DIDR form and within this report. Each item listed could be installed: to current standards, to standards current at the time of installation, not to any appropriate standards or unsure/don't know. For the "incident appliance" items that are standards-related, for the installation, include the correct room/location, proximity to walls, fire resistance and electrical safety.

2 ANALYSIS OF REPORTED DATA

2.1 INCIDENT DETAILS - ANALYSIS OF SECTION 1 OF DIDR

Transco issued 294 Incident Notification Forms during the reporting period. These gave details of CO Poisoning Reports under their internal reporting procedures.

There were 95 domestic incidents that met the requirements for reporting on the DIDR form. The majority of these being notified directly to Transco as part of the operation of the national gas emergency service and advised by Transco's internal procedures. In addition there were some incidents reported directly to gas suppliers by, for example, coroners or the police that were not entered onto Transco's reporting system. All reports were fully analysed for this report and every effort was made to obtain as many completed DIDR forms as possible. However due to the voluntary nature of the reporting scheme, it is likely that a very small number of reports were not supplied. If any additional reports should be received after publication of this report, they will be included within updated annual statistical tables in future reports. Each form is treated as a separate DIDR incident and will be referred to as an "incident" throughout the rest of this report. The incident risk data and trend data have been combined with the casualty details and are described within section 2.2.

The date of occurrence of each domestic incident has been plotted by month, in Figure 1, for the 12 month period April 2000 to March 2001.

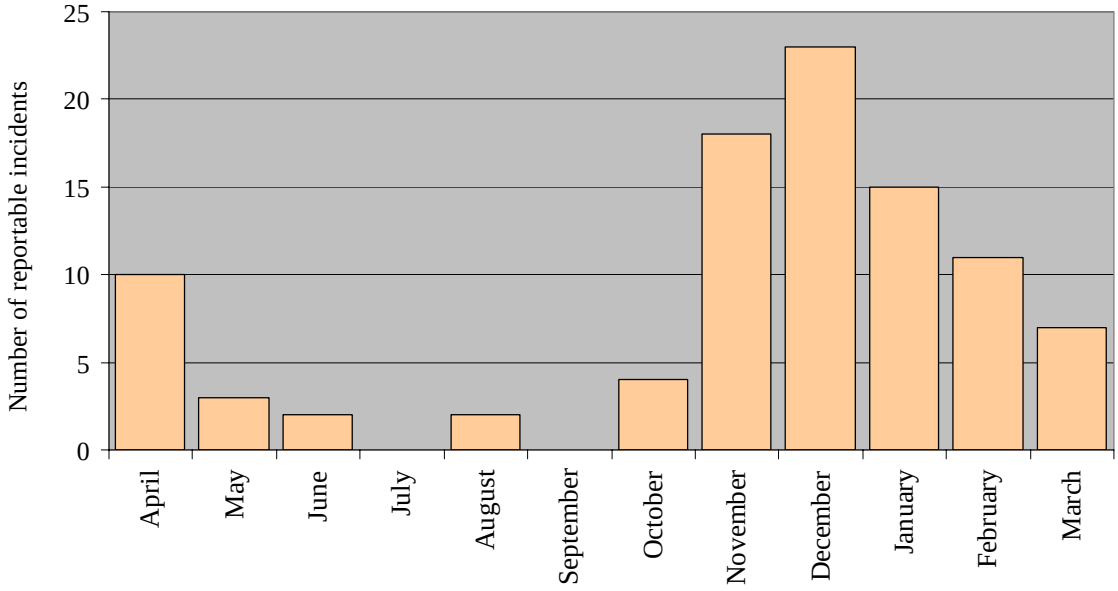

Figure 1 - Profile of incident occurrences over the year

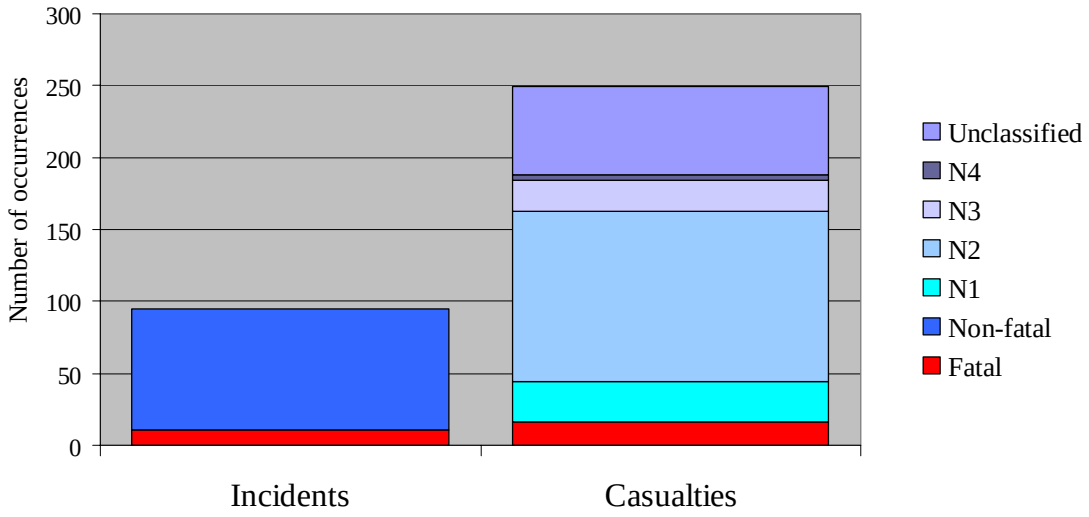

Figure 2 - Incident analysis

Figure 2 gives the number of reported domestic occurrences of CO incidents and CO casualties that took place during the year 2000/01. Further information on casualty groups are given in section 2.2 of this report.

Details of the LPG incidents that occurred during the year are given in Appendix C and details of non-domestic incidents are given in Appendix D.

2.2 CASUALTY DETAILS - ANALYSIS OF SECTION 2 OF DIDR

The total number of people reported by the DIDR system to have been injured in domestic CO poisoning incidents, by piped natural gas and within the reporting period for 2000/01, is presented below in Table 1.

Table 1 - Classification of non-fatal casualties

Classification	*N1*	*N2*	*N3*	*N4*	*Total*
Number of casualties	28	119	21	4	233

Table 1 indicates the breakdown of the non-fatal casualties by casualty classification N1 to N4, as used on the DIDR form. The four classifications 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 Paramedics)
N4 - receiving no medical treatment (e.g. treatment refused)

Note: There were some non-fatal casualties that were unclassified.

Figure 2, in section 2.1, gives the number of occurrences of incidents and casualties that took place during the year. Using this information a corresponding risk data analysis has been carried out. The results from this are given in Table 2. The table also includes details of the number of fatalities and the number of incidents reported on the DIDR form.

Table 2 - The number of CO incidents and casualties, used for the risk analysis, with the corresponding risk values

Total number of incidents	*Total number of fatal casualties*	*Total number of non-fatal casualties*	*Over-all IPPY ($x10^{-6}$)*	*Over-all FPPY ($x10^{-6}$)*	*Over-all CPPY ($x10^{-6}$)*
95	16	233	2.09	0.35	5.14

In the calculation of FPPY, CPPY and IPPY the following statistics were used for this report.

a) The number of domestic customers i.e. the number of households using piped natural gas for 2000/01 = 20.08 million - see section 7.1.3.

b) The average number of people per household in Great Britain for 2000/01 = 2.26 - see section 7.1.4.

Note: In the calculation of FPPY, CPPY and IPPY [a x b] replaces [Number of people at risk x Appliance Population]. Definitions are given in Appendix A.

Overall trends are given in Table 3 and plotted in Figures 3 and 4.

Table 3 - Trend data

Trend category	*Reporting year*			
	93/94	*94/95*	*95/96*	*96/97*
Total number of deaths (A)	29	31	-	25
FPPY (B)	0.65	0.69	-	0.54
Total non-fatal casualties (C)	167	189	-	121
CPPY (D)	4.4	4.2	-	2.63
Total number of incidents (E)	86	102	-	67
IPPY (F)	1.9	2.3	-	1.46

Trend category	*Reporting year*			
	97/98	*98/99*	*99/00*	*00/01*
Total number of deaths (A)	22	23	24	16
FPPY (B)	0.48	0.49	0.53	0.35
Total non-fatal casualties (C)	224	231	130	233
CPPY (D)	4.92	4.9	2.88	5.14
Total number of incidents (E)	97	107	63	95
IPPY (F)	2.13	2.3	1.39	2.09

Notes to Table 3:
A = Total number of deaths due to CO poisoning in each financial year
B = FPPY (Average fatalities per person per year are $x10^{-6}$). The FPPY was calculated by the same method as that used for Table 2.
C = Total number of non-fatal casualties due to CO poisoning in each financial year.
D = CPPY (Average non-fatal casualties per person per year are $x10^{-6}$). The CPPY was calculated by the same method as that used for Table 2.
E = Total number of incidents due to CO poisoning in each financial year.
F = IPPY (Average incidents per person per year are $x10^{-6}$). The IPPY was calculated by the same method as that used for Table 2.
Following the restructuring of British Gas, insufficient information was collected to enable the statistics for 1995/96 to be calculated.

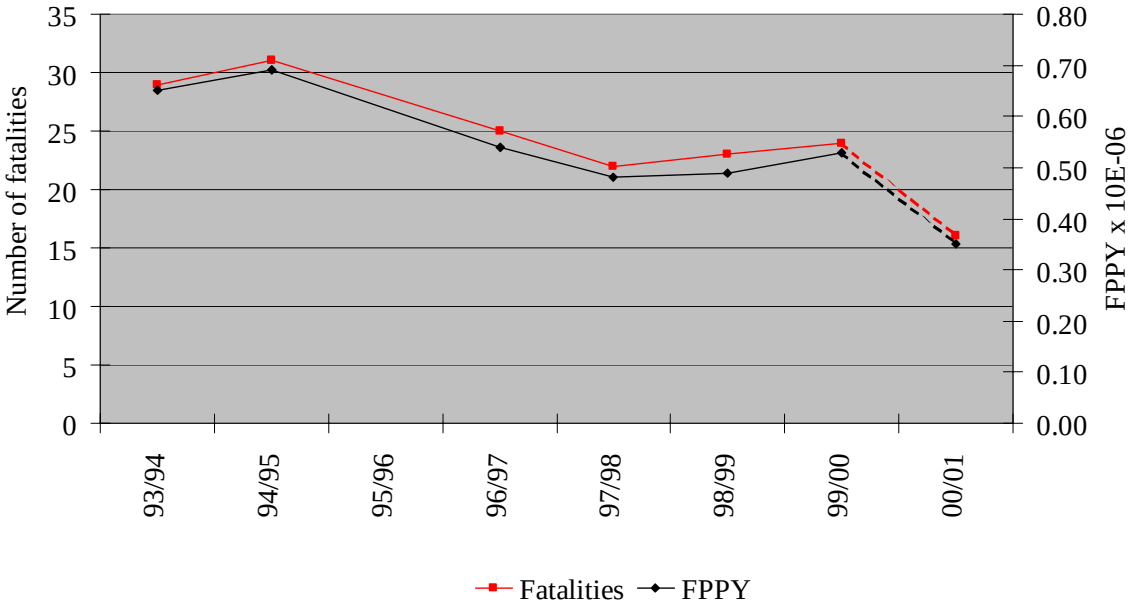

Figure 3 - Graph of fatality trends

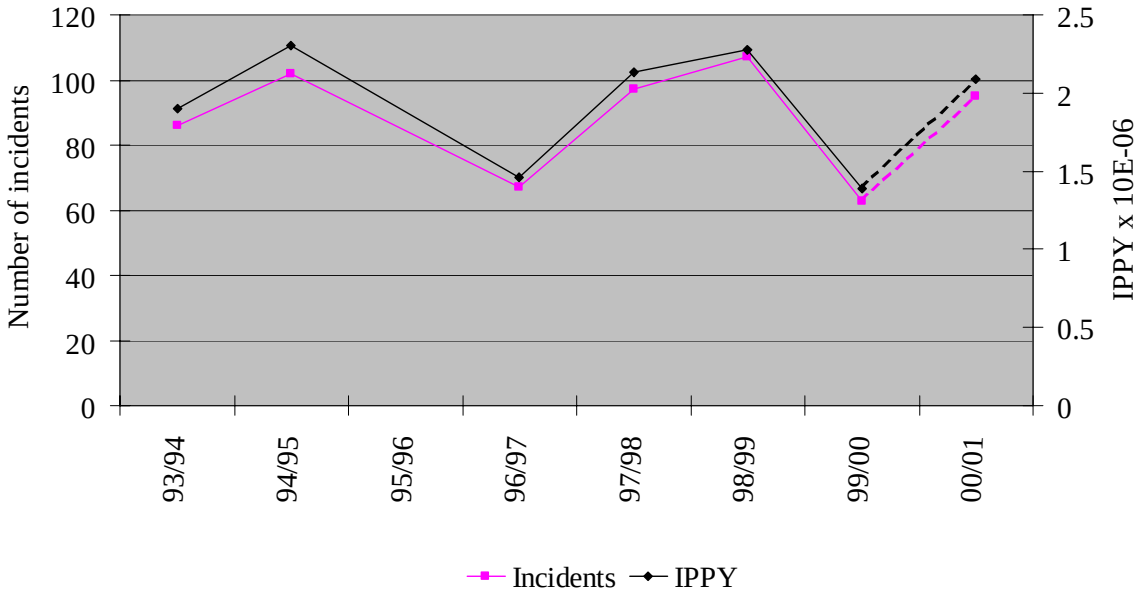

Figure 4 - Graph of incident trends

The age and numbers of the combined totals of the fatal and all non-fatal casualties are given in Figure 5.

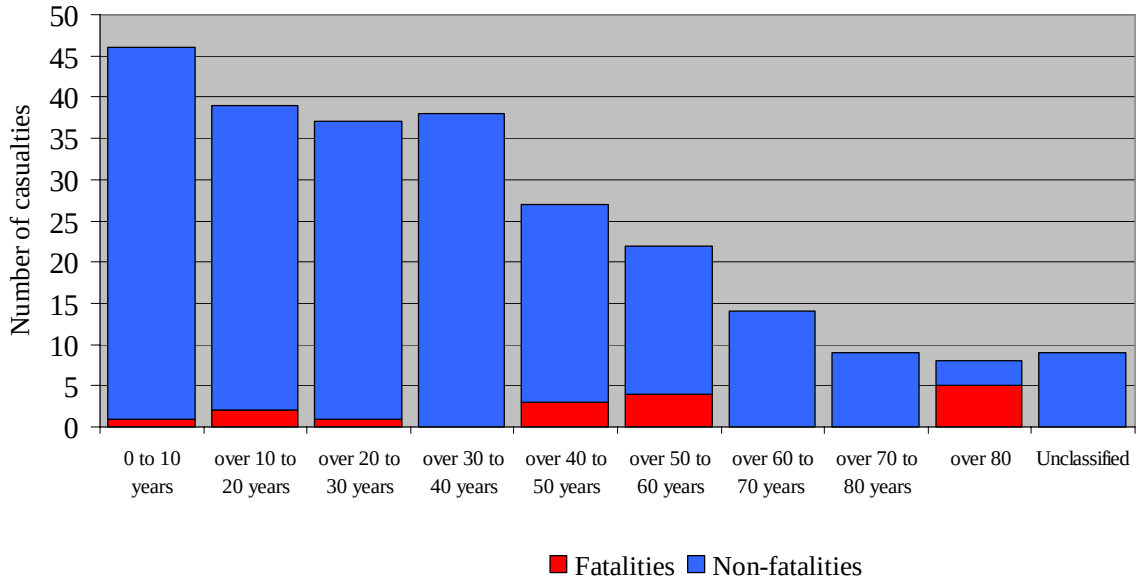

Figure 5 - Casualty age profile

2.3 INCIDENT LOCATION DETAILS - ANALYSIS OF SECTION 3 OF DIDR

Figure 6 gives the occupancy types of the properties shown on the DIDR forms. The percentage owner occupied was 66% and 34% were tenanted. There were no empty fields or unrecognised values. Of the tenanted properties, 29% (27) were single occupancy and 5% (5) were multiple occupancy. The proportion of tenanted properties that were council owned was 11% (11), 3% (3) were owned by registered social landlords and 17% (16) were privately owned. In a further 2 incidents the landlord was unknown.

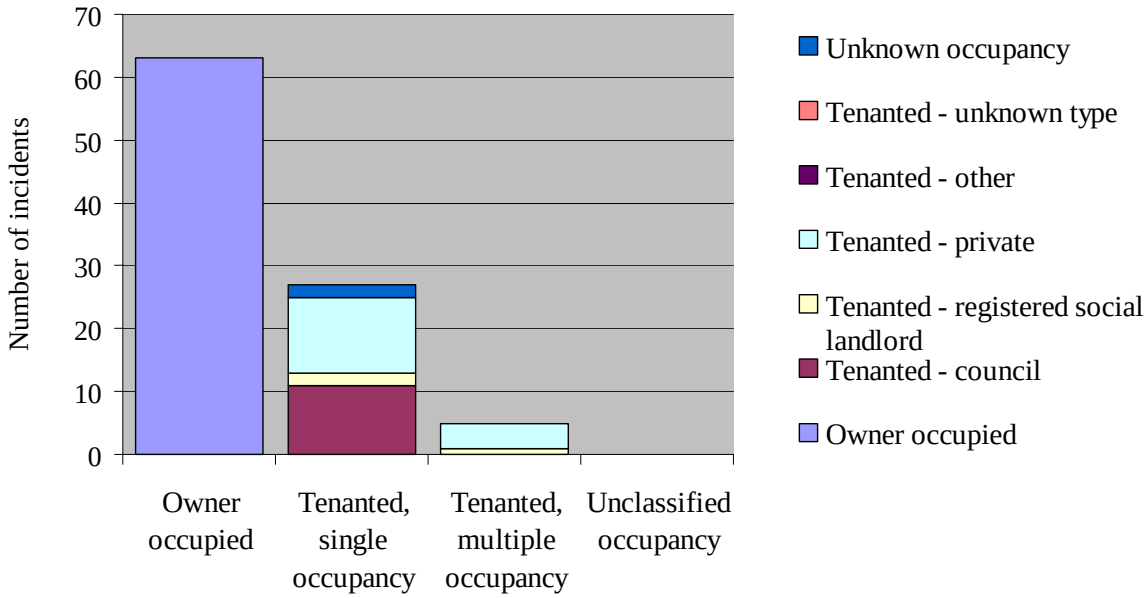

Figure 6 - Occupancy type

Preliminary results of the 2000/01 survey of English Housing from the Department for Transport, Local Government and the Regions give the owner occupied tenure group as 70% and the tenanted sector as 30%. This covers renting from the local authority at 14%, privately at 10% and from a registered social landlord at 6%.

Figure 7 indicates that the highest proportion of incidents occurred in houses (76%), followed by flats (13%).

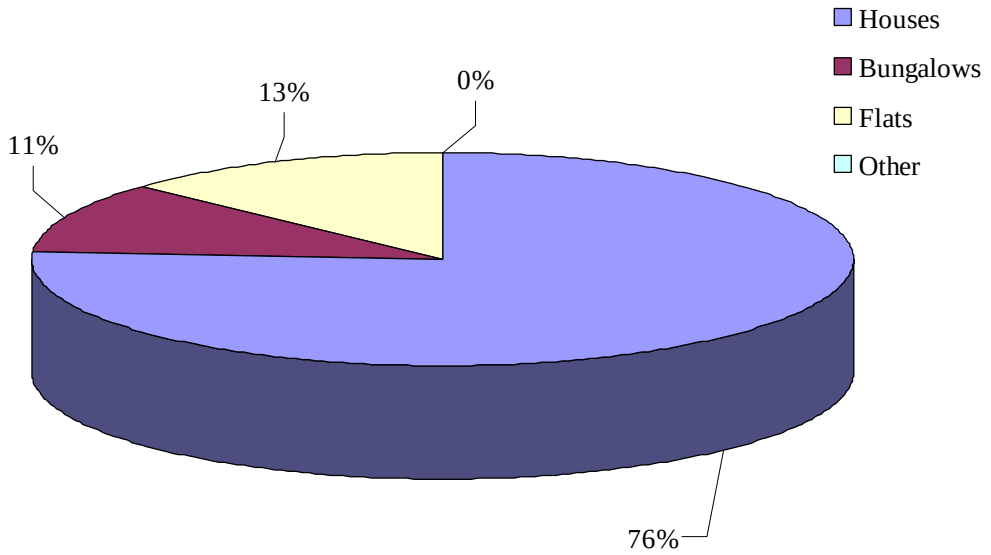

Figure 7 - Property types

Table 4 shows the number and percentage of each style of property, within each property type, in which incidents took place during the year. There were no incident properties categorised as "other". The table indicates that the highest proportion of incidents occurred in terraced houses (40%), followed by detached houses (13.7%).

Table 4 - Breakdown of incident sites by property style

Bungalow	***Nos (%)***	***Flat***	***Nos (%)***	***House***	***Nos (%)***
Detached	7 (7.4)	Bed sit	0 (0)	Detached	13 (13.7)
Semi-detached	3 (3.2)	Conversion	3 (3.1)	Semi-detached	19 (20.0)
Terraced	1 (1.0)	Maisonette	2 (2.1)	Terraced	38 (40.0)
		PBB (4 storeys or less)	7 (7.4)	Townhouse	2 (2.1)
		PBB (5 storeys or more)	0 (0)		

Note: In the table PBB stands for purpose built block.

The 1999/00 survey of English Housing from the Department for Transport, Local Government and the Regions gives the latest available data for the breakdown of the types of accommodation in England. The analysis is given below where it is compared to the incident statistics.

Table 5 - Comparison of DIDR incident stats with accommodation stats

Property style	*Accommodation Stats for England (%)*	*Incident Stats (%)*
Detached house/bungalow	21	21
Semi-det house/bungalow	34	23
Terraced house/bungalow	27	43
Purpose built flat or maisonette	13	9
Converted flat or maisonette/rooms	5	4

The age bands of the properties in which incidents took place are shown on Figure 8.

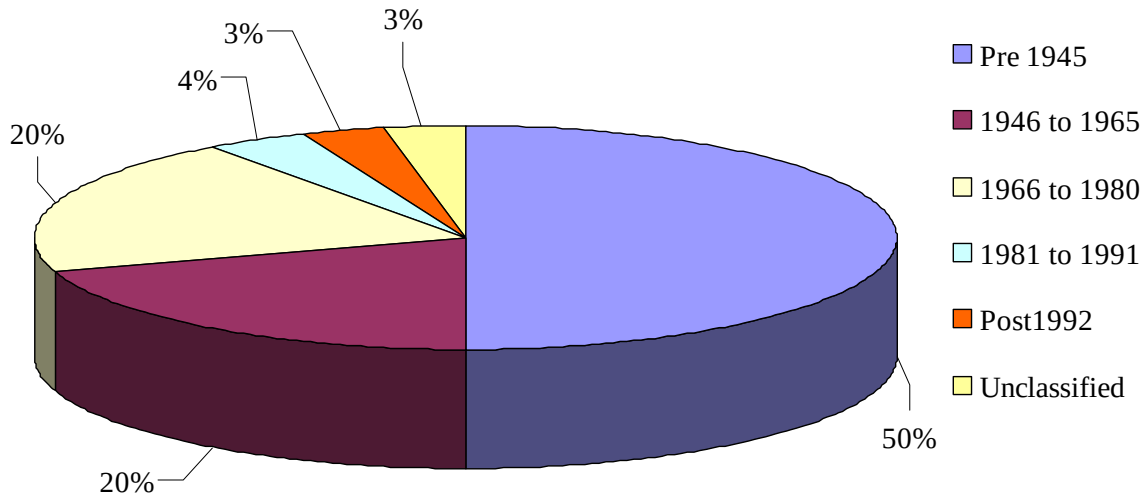

Figure 8 - Property construction period

The three largest sectors are properties built before 1945 at 50% followed by those built between 1946 and 1965 and between 1966 and 1980 which were both recorded at 20%. The age was unspecified for 3% of the incidents. Where the age was specified (92 properties) those built before 1945 are the majority at 51% of incidents. The two next largest groups were both 21% and were for those properties built between 1946 and 1965 and between 1966 and 1980. The remainder, built from 1981, totalled 7%. The 1999/00 survey of English Housing from the Department for Transport, Local Government and the Regions gives the latest available data. It states that for England, 40% of all dwellings were built before 1945, 22% were built in the period 1945 to 1964 and 38% were built during or after 1965.

Table 6 shows the analysis of the glazing and ground floor details for the incident sites. These are also described graphically in Figures 9 and 10.

Table 6 - Construction details of the incident property

Glazing details	*%*	*Ground floor details*	*%*
Single	18	Solid	52
Double	66	Suspended	27
Partial double	9	Partial solid	9
Unclassified	7	Unclassified	12

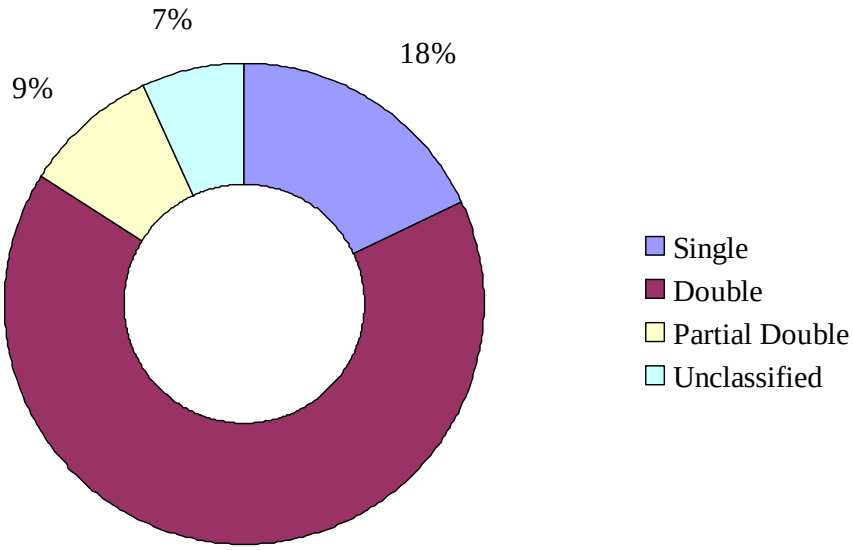

Figure 9 - Glazing details

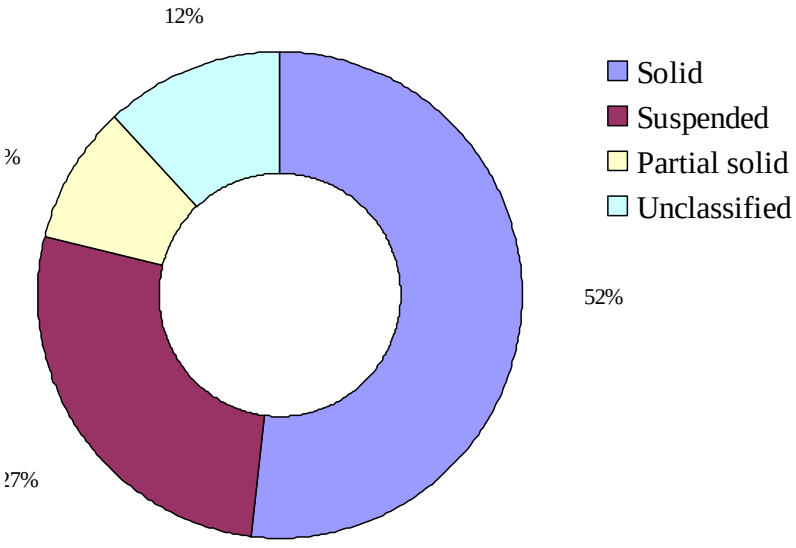

Figure 10 - Ground floor construction

2.4 CASUALTY & APPLIANCE LOCATION - ANALYSIS OF SECTION 4 OF DIDR

The location of the incident appliance and the casualties are given below in Table 7.

Table 7 - Appliance and casualty locations

Location	*Number of appliances at each location*	*Number of casualties at each location*	*Number of casualties reported in the same room as the appliance*
Attic	0	0	0
Bathroom	0	10	0
Bedroom	4	87	4
Bedsit	0	0	0
Cellar	4	0	0
Dining Room	2	6	0
Utility	5	1	1
Garage	0	0	0
Hall	13	10	1
Kitchen	46	26	25
Landing	3	0	0
Living room/lounge	15	86	20
Shower-room	0	1	0
Other	2	9	0
Unclassified	1	4	-

The “Other” appliance locations indicated in Table 7 were a toilet and a boiler room whereas the casualty the locations were described as one in ”other rooms”, 7 in “various rooms” and 1 in a “door to a kitchen”. Of the 95 incident sites 58 (61%) of incident appliances were located in rooms, with 24 (25%) described as being located in compartments. Of the remainder, one appliance was located in a stair well, one in a “passageway” and one was a “slot fit”. The final ten were not coded. This information is shown on Figure 11.

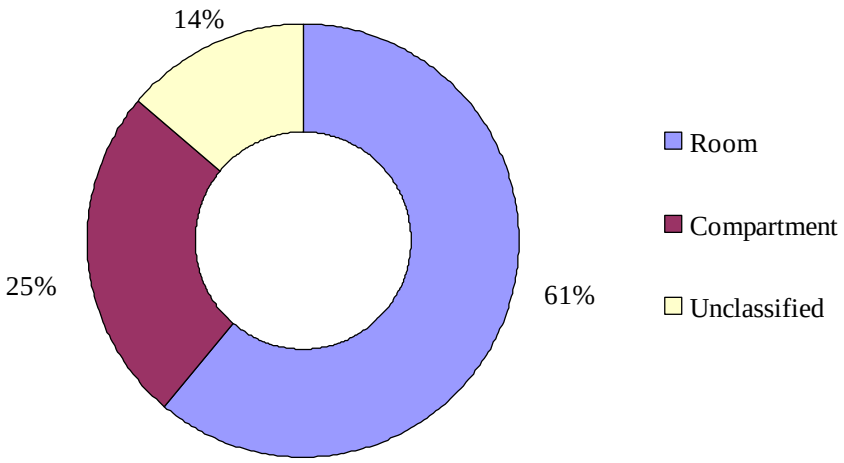

Figure 11 - Appliance location

There were 5 incident sites where the incident appliance was located in an extension to the original building. The investigator was also requested to submit details for any incident sites where appliances, not including the incident appliance, were found to be producing CO into the property or which had "sub-standard faults". There were 17 incident sites where additional appliances were found to be introducing CO into the property. At fifteen of these sites there was 1 additional appliance, at 1 site there were 2 additional appliances and at the final site there were 3 additional appliances. There were also 16 incident sites where additional appliances were found to have "sub-standard" faults, comprising 1 appliance at 8 sites, 2 appliances at 6 sites and 3 appliances at a further 2 sites. Details of incident appliance locations, by floor, are given in Table 8.

Table 8 – Location of the incident appliances

Floor on which the appliance was situated	*Number of incident appliances*
Forth	1
Third	0
Second	3
First	7
Ground	70
Below ground	4
Unclassified	10

At 89 (94%) incidents the casualties were in the same property as the incident appliance and in 6 incidents the details were not coded. During this reporting period there were no incidents due to appliances located in adjacent properties as shown on Figure 12.

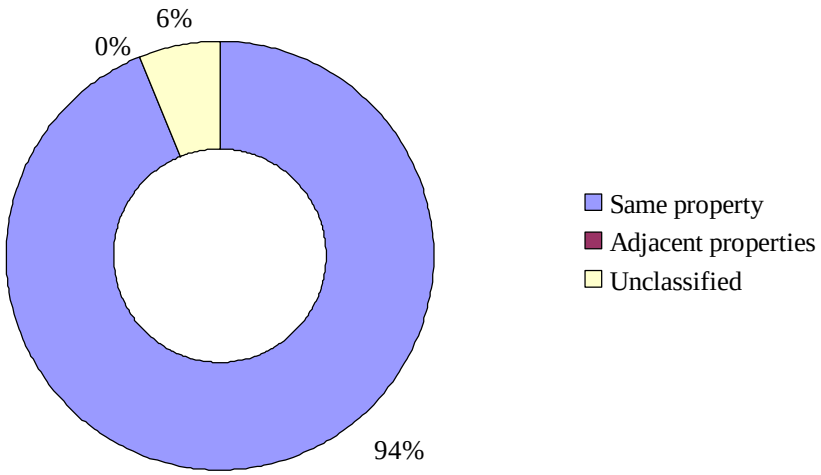

Figure 12 - Casualty/Appliance location

2.5 INCIDENT APPLIANCE DETAILS - ANALYSIS OF SECTION 5 OF DIDR

2.5.1 Incidents during 2000/01

Details of the CO poisoning incidents for 2000/01, by appliance type, are given in Table 9 and summarised in Figure 13.

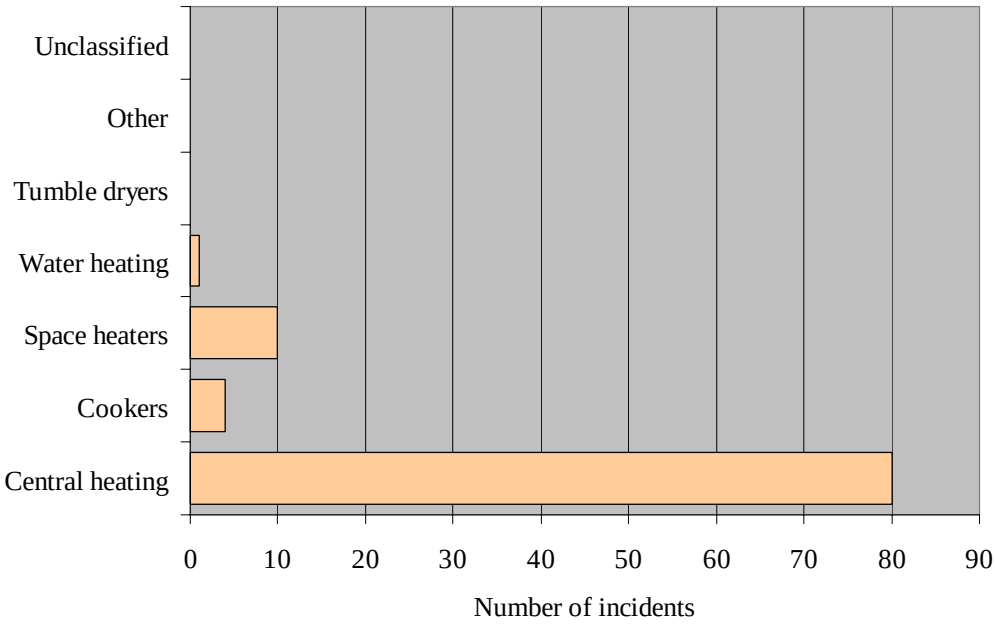

Figure 13 - Incidents by appliance type

TABLE 9 - Incidents by appliance types

Appliance	*Incidents (All) - Total*	*Incidents - Fatal*	*Casualties – Non-fatal*	*Casualties - Fatal*
Central Heating				
Back boiler unit	7	0	18	0
Floor standing	20	3	49	4
Floor standing combi	0	0	0	0
Thermal storage unit	1	0	1	0
Wall mounted	27	2	73	4
Wall mounted combi	19	2	48	3
Warm air unit	5	1	15	2
Total	**79**	**8**	**204**	**13**
Cookers				
Free standing	3	0	7	0
Built-in oven	0	0	0	0
Built-in hob	0	0	0	0
Total	**3**	**0**	**7**	**0**
Space Heaters				
Balanced flue g .f.	0	0	0	0
Cabinet heater	0	0	0	0
Decorative g .f.	0	0	0	0
Flueless heater	0	0	0	0
Inset live fuel effect g .f.	1	0	1	0
Rad. & rad. con. g .f.	9	3	9	3
Wall heater	0	0	0	0
Total	**10**	**3**	**10**	**3**
Tumble Dryers				
Tumble Dryers (total)	**0**	**0**	**0**	**0**
Water Heaters				
Bulk storage	0	0	0	0
Circulator	0	0	0	0
Multi-point	0	0	0	0
Single-point	1	0	4	0
Total	**1**	**0**	**4**	**0**
“Other” Appliances				
	2	**0**	**8**	**0**
Grand Total	**95**	**11**	**233**	**16**

Notes: Appendix B gives details, by appliance type, for each incident. In the above table and following tables g .f. has been used as an abbreviation for gas fire.

There were no reports of any condensing appliances having been involved in any incidents during this reporting period.

The breakdown of the types of central heating boiler units involved in incidents are given in Figure 14.

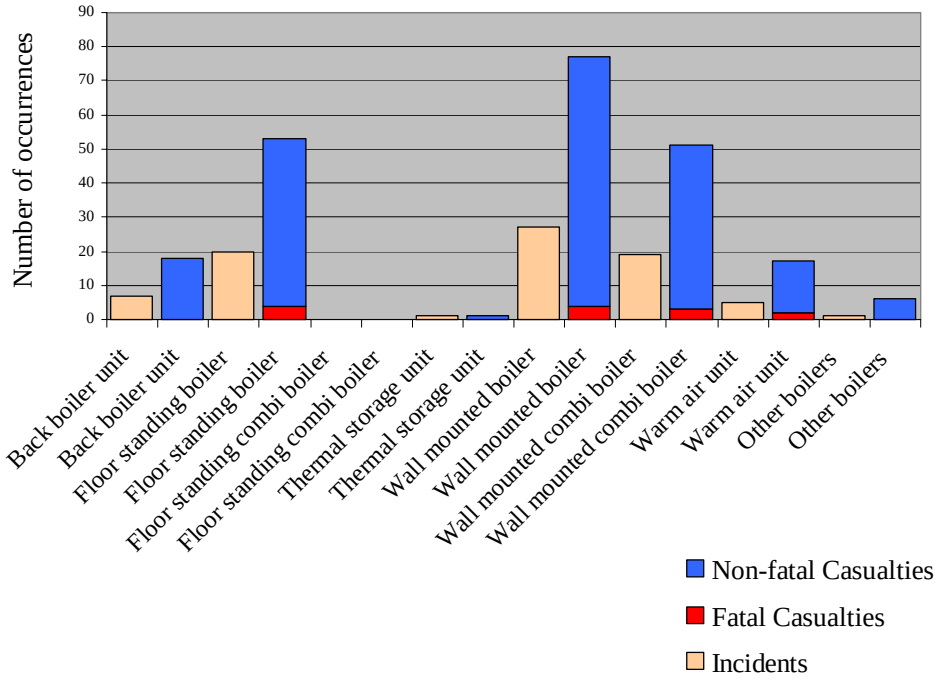

Figure 14 - Central heating boilers

Figure 15 shows the fatality trends associated with appliance type since 1993/94. It is likely that there have been changes to the profile of gas appliances in use, within Britain, between 1993/94 and 2000/01. The FPPY risk values shown in Table 13, section 2.5.4, take account of these changes.

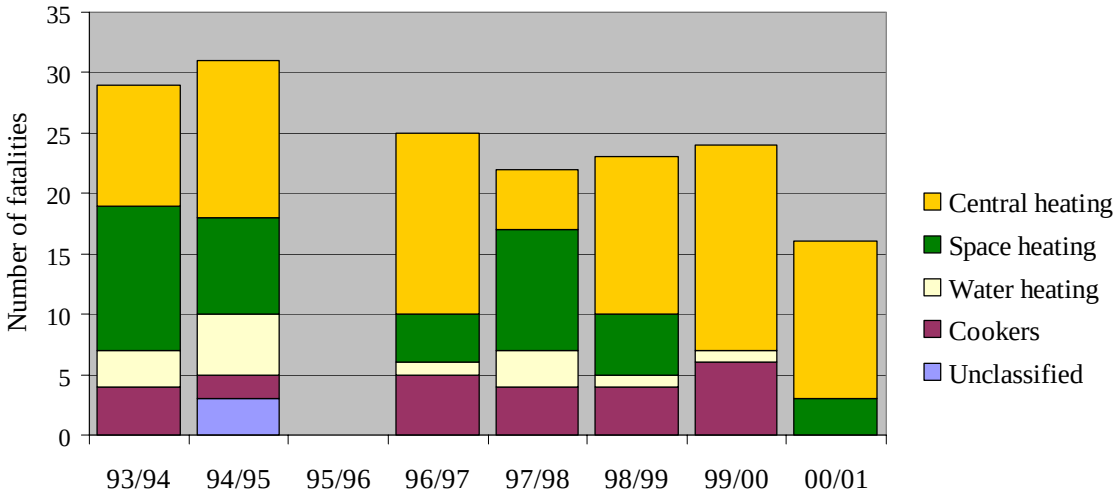

Figure 15 - Fatalities by appliance type

The age of the appliances involved in incidents during the reporting period has been given under the main appliance groups in Table 10. It is also described in Figure 16.

Table 10 - Age of incident appliances

Appliance Type	*Age (years)*					
	0 –5	*6 - 10*	*11 - 15*	*16 - 20*	*Over 20*	*Unknown*
Central heating	5	7	5	4	2	57
Cookers	0	0	0	0	0	4
Space heaters	0	0	2	0	0	8
Tumble dryers	0	0	0	0	0	0
Water heaters	0	0	0	0	0	1
Grand Total	**5**	**7**	**7**	**4**	**2**	**70**

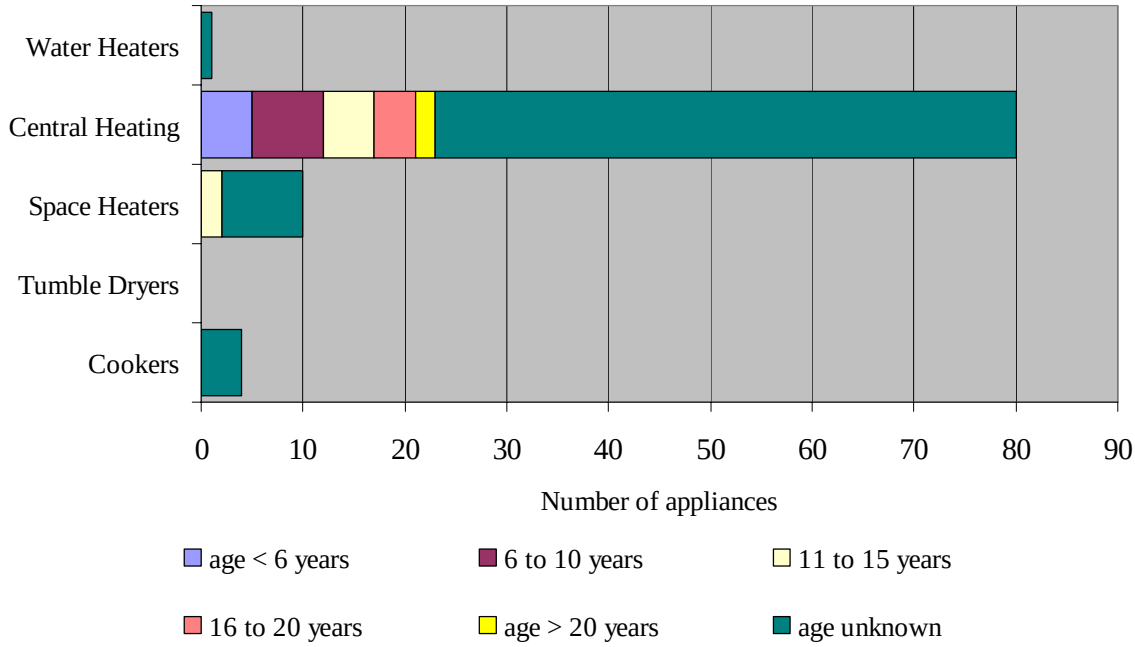

Figure 16 - Appliance age distribution

2.5.2 Notes relating to individual appliance types and models

The following information is derived from the incident details given in Table 9 and Appendix B:

2.5.2.1 Central Heating

Central heating appliances featured in 79 incidents, which is just over four-fifths of all CO poisoning incidents reported during the year. The number of fatalities reported at 13 was over three quarters of the total recorded, with the number of non-fatal casualties being 204 (88%).

Wall mounted boilers were involved in 34% of the central heating incidents, with floor standing boilers and wall mounted combi boilers being the next highest groups at 25% and 24%, respectively. Wall mounted boilers and floor standing boilers were both responsible for the highest number of fatalities, at 4 each, with wall mounted combi boilers being responsible for 3 fatalities and warm air units being responsible for 2 fatalities. For 4 incidents the investigator did not establish the cause of the incident or it was not known. This resulted in a reduction in the detail entered on the DIDR form in areas such as the on-site checks.

Note: Some appliance models may appear under several different manufacturers' names within Appendix B. For example Apollo boilers have been entered onto the database under Thorn and Myson.

Back boiler units

Back boiler unit incidents totalled 7, with no fatalities and 18 non-fatal casualties. The boilers were all open flued natural draught appliances installed in the living room/lounge. Three were Housewarmer models by Myson/Thorn/Glow-Worm, two were Baxi Bermuda models and the remaining two were both Glow-Worm models.

At 6 sites the ventilation was to current standards and at 5 sites the flue was to current/current-when-installed standards. Lack of servicing was given as the cause of the incident at 6 of the 7 sites and sub-standard servicing at the remaining site. This was indicated by 5 appliances having a defective flame picture, 5 where the heat exchanger was blocked by soot and 5 where linting had occurred. In all, 6 appliances had a high CO/CO2 ratio.

Floor standing boilers

Floor standing boiler incidents totalled 20, with 4 fatalities and 49 non-fatal casualties. A room sealed natural draught boiler was installed at one location, with the remainder being open flued natural draught appliances. Six of the appliances were Potterton Kingfisher models and 3 were Ideal/Stelrad Mexico models. Eleven were fitted in a kitchen, two in a bedroom and the one listed as "other" was located in a boiler room.

In 18 installations the ventilation was not to standard and in 12 cases the flue was not to standard. Terminal siting was poor in 11 instances and there was a flue installation defect at 10 sites. Weather was also thought to have contributed to the poor performance of the appliance in 16 of the incidents. In 10 incidents linting had taken place and there was found to be a high CO/CO2 ratio at 12 sites. The appliance was installed in a compartment/cupboard which was "not to any standards" at a total of 8 sites.

The incident summary lists incident causes and indicates that in 9 cases the appliance was in need of servicing or had been serviced inadequately. At 4 sites the compartment was sub-standard. There were four causes in the "other" category. These were the "weather", "water in pipes", "cavity wall insulation" and "boiler enclosed". For one incident the investigator did not establish the cause of the incident or it was not known. This resulted in a reduction in the detail entered on the DIDR form in areas such as the on-site checks.

Floor standing combi boilers

There were no recorded incidents involving these appliances.

Thermal storage units

There was 1 recorded incident involving this appliance type with 1 non-fatal casualty. The Range Powermax model involved had an appliance fault which caused the incident. It had a pressurised case, room sealed flue which was to standards. When tested it required servicing as the flame picture was defective, it had a high CO/CO2 ratio and the heat exchanger was blocked by soot. The appliance rating was set high and there were signs that external spillage had taken place.

Wall mounted boilers

Wall mounted boilers were involved in 27 incidents, with 4 fatalities and 73 non-fatal casualties. Twenty-two of the appliances were open flued, natural draught and 3 were room sealed natural draught. One had a room sealed, fanned flue, with a pressurised case, and 1 had an open flued, shared natural draught flue. Seventeen of these boilers were fitted in a kitchen.

9 Glow-Worm Fuelsaver models, 4 Thorn/Myson Apollo, 4 Glow-Worm Spacesaver and 3 Potterton Flamingo models featured in 20 of the incidents. In 21 installations the flue was not to standard and in 13 cases the ventilation was not to standard. There was a flue installation fault at 19 sites and the terminal siting was said to be poor in 15 instances. The appliance failed the spillage test at 13 sites and also at 13 sites there were signs of spillage outside the appliance.

Weather was thought to have contributed to the poor performance of the appliance in 20 of the incidents. There was a high CO/CO2 ratio at 20 sites and 18 heat exchangers were blocked by either soot or shale. In 14 incidents linting had taken place and at 11 sites there was a defective flame picture.

The incident summary lists incident causes and indicates that in 17 cases the appliance was in need of servicing or had been serviced inadequately. A flue/terminal fault was listed 12 times and a ventilation fault 7 times. There was one cause listed in the "other" category. This was given as "vitiation".

Wall mounted combi boilers

Combi boilers were involved in 19 incidents. There were a total of 48 non-fatal casualties and 3 fatal casualties. Fifteen appliances were open flued, natural draught models and two of these had shared flues. One appliance was a room sealed, individual, natural draught model, fitted in a bedroom, and 3 were room sealed, individual, fanned draught models. Two of these had a depressurised casing and the third had a pressurised case. Vaillant models featured 12 times, with the T3 model and the GB both appearing 5 times. Eight appliances were fitted in a kitchen and one appliance was fitted in each of the following: the bedroom, hall and landing. The one remaining location was given as "other", which was a toilet.

The flue was not to standard in 12 cases, and there were 10 sites where the ventilation was not to standard. The terminal was said to be badly sited at 8 incident sites and there were flue installation faults at 9 sites. The weather also featured in 11 incidents. There was a high CO/CO2 ratio at 15 sites, with linting at 9 sites and signs of internal spillage on 12 appliances.

The incident summary lists incident causes, and indicates that in 8 cases the appliance was in need of servicing or had been serviced inadequately. A flue/terminal fault was listed 8 times. There was one cause listed in the "other" category, which was given as "interference".

Warm air units

There were 5 incidents involving warm air units with 2 fatalities and a total of 15 non-fatal casualties. Johnson & Starley manufactured four of the five incident appliances. All appliances were open flued, natural draught models and one had a shared flue.

At 4 sites the appliances were installed in sub-standard compartments with ventilation arrangements that were also sub-standard. Four failed a spillage test and three had a defective flame picture and a heat exchanger blocked by soot.

The incident summary lists incident causes, and indicates that in 3 cases there was an appliance installation fault together with a ventilation fault. In 2 cases it was reported that causes were a lack of servicing, sub-standard servicing and a sub-standard compartment.

"Other" boilers

There was one incident in this category involving a combined central heating unit/cooker. The ventilation and flue were not to standard, the ventilator fitted was blocked and several other maintenance faults were noted. The incident summary lists incident causes, and indicates that there was a flue/terminal fault and a ventilation fault and also that the weather contributed to the cause of the incident.

2.5.2.2 Cookers

There were 3 incidents, with no fatalities and 7 non-fatal casualties, involving free standing cookers. The appliance was a Flavel Leisure model in each incident and all the problems found were related to a burner. The incident summary lists incident causes, and indicates that there was a lack of servicing for all of the appliances.

There was also one incident in the "other" category involving a Leisure 76 model, which also had only burner faults and a lack of servicing as an incident cause.

2.5.2.3 Space Heaters

The ten space heaters, which featured in incidents, were 9 radiant/radiant-convector gas fires and 1 inset live fuel effect gas fire. There were 3 fatalities and 10 non-fatal casualties. The appliance model was different in each incident, and they were all open flued, natural draught models.

In 6 incidents there were signs of spillage outside the appliance case and in 5 cases linting had taken place. Three appliances had a defective flame picture and flue blockage.

In 5 incidents the cause of the incident was identified as a flue/terminal fault and in 3 cases it was attributed to a lack of servicing.

2.5.2.4 Tumble Dryers

There were no recorded incidents involving these appliances.

2.5.2.5 Water Heaters

The only incident involving a single point water heater led to 4 non-fatal casualties. It involved a flueless model where the ventilation that had been provided was not to standard. The heat exchanger was cracked and blocked by hard water scale and verdigris. Linting had taken place to the burner and the flame picture was also defective. These faults led to high levels of CO being produced by the appliance. Causes of the incident were given as a lack of servicing and an appliance fault.

2.5.3 Appliance risk values

Details relating to the risk values, for the 2000/01 period, by appliance type are shown in Table 11. In terms of the risk of a fatal incident (FPPY) no appliances had a risk value greater then the recommended level of 1×10^{-6}.

The two worst appliances, in descending order of risk, are as follows: Warm air units (0.73×10^{-6}) and Floor standing boilers (0.67×10^{-6}).

Table 11 - Risk values by appliance type

Appliance	*Population ($x10^6$)*	*FPPY ($x10^{-6}$)*	*CPPY ($x10^{-6}$)*	*IPPY ($x10^{-6}$)*
Central Heating				
Back boiler unit	3.15	-	2.53	0.98
Floor standing	2.64	0.67	8.21	3.35
Floor standing combi	-	-	-	-
Thermal storage unit	-	-	-	-
Wall mounted	6.30	0.28	5.12	1.90
Wall mounted combi	4.30	0.31	4.94	1.95
Warm air unit	1.22	0.73	5.46	1.82
Cookers				
Free standing	8.81	-	0.35	0.15
Built-in oven	-	-	-	-
Built-in hob	-	-	-	-
Space Heaters				
Balanced flue g .f.	-	-	-	-
Cabinet heater	-	-	-	-
Decorative g .f.	-	-	-	-
Flueless heater	-	-	-	-
Inset live fuel effect g .f.	-	-	-	-
Rad. & rad. Con. g .f.	7.00	0.19	0.57	0.57
Wall heater	-	-	-	-
Tumble Dryers				
Tumble dryers	-	-	-	-
Water Heaters				
Bulk storage	-	-	-	-
Circulator	-	-	-	-
Multi-point	-	-	-	-
Single-point	0.17	-	10.41	2.60

Note: Population figures provided by GfK Marketing Services Ltd. (Reference 7.1.1). Population figures were not available for all appliance types and therefore risk values could not always be calculated. Space and water heater population data was based upon 1998/99 returns.

2.5.4 Trends (1993/94 to 2000/01)

Trends regarding CO poisoning incident fatalities by appliance type are given in Table 12 and are also shown in Figure 15, which is in section 2.5.1 of the report. The table has been completed as fully as possible, using information that was available from the 2000/01 DIDR forms and from historical records held by Advantica (Reference 7.1.2).

Table 12 - Trend data of the number of fatalities due to CO incidents, by appliance type

Appliance	*Year*							
	93/94	**94/95**	**95/96**	**96/97**	**97/98**	**98/99**	**99/00**	**00/01**
C/H Boilers -Total	**10**	**13**	**-**	**15**	**5**	**13**	**17**	**13**
Back boiler unit	-	1	-	3	-	6	-	-
Floor standing	-	6	-	2	2	1	1	4
Floor standing combi	-	-	-	-	-	-	-	-
Thermal storage unit	-	-	-	-	-	-	-	-
Wall mounted	2	1	-	5	2	3	9	4
Wall mounted combi	2	2	-	3	1	1	7	3
Warm air unit	1	2	-	1	-	2	-	2
Cookers -Total	**4**	**2**	**-**	**5**	**4**	**4**	**6**	**-**
Free standing	-	-	-	5	4	4	6	-
Built-in oven	-	-	-	-	-	-	-	-
Built-in hob	-	-	-	-	-	-	-	-
Space Heaters -Total	**12**	**8**	**-**	**4**	**10**	**5**	**-**	**3**
Balanced flue g .f.	-	-	-	-	-	-	-	-
Cabinet heater	-	-	-	-	-	-	-	-
Decorative g .f.	-	-	-	-	-	-	-	-
Flueless heater	-	-	-	-	-	-	-	-
Inset live fuel effect g .f.	-	-	-	-	-	-	-	-
Rad. & rad. con. g .f.	-	-	-	3	10	5	-	3
Wall heater	-	-	-	-	-	-	-	-
Tumble Dryers	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Water Heaters -Total	**3**	**5**	**-**	**1**	**3**	**1**	**1**	**-**
Bulk storage	-	-	-	-	-	-	-	-
Circulator	-	-	-	-	-	-	-	-
Multi-point	-	-	-	-	-	-	-	-
Single-point	-	-	-	1	3	1	1	-
Other	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**
Grand Total	**29**	**31**	**-**	**25**	**22**	**23**	**24**	**16**

Trends in terms of the risk of a fatality by appliance type, expressed as FPPY values, are shown in Table 13. This table has also been completed as fully as possible, using information that was available from the 2000/01 DIDR forms and from historical records held by Advantica.

Table 13 - Trend data of fatalities per person per year (FPPY)

Appliance	*Year*							
	93/94	**94/95**	**95/96**	**96/97**	**97/98**	**98/99**	**99/00**	**00/01**
C/H Boilers -Total	**0.17**	**0.27**	**-**	**0.38**	**0.12**	**0.31**	**0.43**	**0.33**
Back boiler unit	-	-	-	0.39	-	0.79	-	-
Floor standing	-	-	-	0.23	0.26	0.14	0.17	0.67
Floor standing combi	-	-	-	-	-	-	-	-
Thermal storage unit	-	-	-	-	-	-	-	-
Wall mounted	37.5	0.65	-	0.27	0.11	0.18	0.63	0.28
Wall mounted combi	0.54	0.54	-	1.1	0.17	0.13	0.84	0.31
Warm air unit	0.70	1.38	-	0.76	-	1.60	-	0.73
Cookers -Total	**0.01**	**0.07**	**-**	**0.16**	**0.13**	**0.12**	**0.18**	**-**
Free standing	-	-	-	0.24	0.19	0.18	0.29	-
Built-in oven	-	-	-	-	-	-	-	-
Built-in hob	-	-	-	-	-	-	-	-
Space Heaters -Total	**0.36**	**0.24**	**-**	**-**	**-**	**-**	**-**	**-**
Balanced flue g .f.	-	-	-	-	-	-	-	-
Cabinet heater	-	-	-	-	-	-	-	-
Decorative g .f.	-	-	-	-	-	-	-	-
Flueless heater	-	-	-	-	-	-	-	-
Inset live fuel effect g .f.	-	-	-	-	-	-	-	-
Rad. & rad. con. g .f.	-	-	-	0.16	0.54	0.28	-	0.19
Wall heater	-	-	-	-	-	-	-	-
Tumble Dryers	-	-	-	-	-	-	-	-
Water Heaters -Total	**0.90**	**1.47**	**-**	**-**	**-**	**-**	**-**	**-**
Bulk storage	-	-	-	-	-	-	-	-
Circulator	-	-	-	-	-	-	-	-
Multi-point	-	-	-	-	-	-	-	-
Single-point	-	-	-	3.81	8.78	2.60	2.77	-
Other	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Grand Total	**0.28**	**0.29**	**-**	**-**	**-**	**-**	**-**	**-**

Note: In Table 13 all the FPPY values are x10^{-6}

2.6 APPLIANCE INSTALLATION DETAILS - ANALYSIS OF SECTION 6 OF DIDR

Incident appliances were installed new at 48 sites (51%). They were second hand at 3 sites (3%) and it was unknown if the appliance was fitted as new or second hand for the remaining 44 (46%) incident locations. The period that the incident appliance was fitted, prior to the incident, is given in Table 14 along with the number of appliances in each age group.

Table 14 - Installation period for incident appliances

Appliance type	*Age (years)*						*Total*
	0 - 5	*6 - 10*	*11 - 15*	*16 - 20*	*Over 20*	*Unknown*	
New	5	7	5	5	3	23	48
Second-hand	0	1	0	0	0	2	3
Unknown	0	1	4	1	1	37	44
Grand Total	**5**	**9**	**9**	**6**	**4**	**62**	**95**

The incident appliance was known to have been installed by a CORGI registered fitter (or equivalent) in 12 incidents, by a non-CORGI registered fitter in 1 case and by DIY persons in 0 incidents. Unknown persons fitted the remaining 82.

In 57 (60%) incidents the appliance was fitted to current standards. The appliance was installed to the standards current at the time of installation in a further 24 (25%) of the 95 incidents recorded. The appliance was not installed to any appropriate standards in 12 incidents and it was unknown for the remaining 2 incidents. These details are given in Table 15.

Table 15 – Appliance installation details

Installer details	*To current standards*	*To standards current at time of installation*	*Not to any appropriate standards*	*Unsure/don't know*	*Total*
CORGI or equivalent	9	1	2	0	**12**
Non-CORGI	1	0	0	0	**1**
DIY	0	0	0	0	**0**
Unknown	47	23	10	2	**82**
Grand Total	**57**	**24**	**12**	**2**	**95**

Reasons given for non-compliance with the appliance installation included: no cooker stability bracket (3 times), return air ductwork faults (3 times), incorrect appliance location in a bedroom (2 times), undersized pipework, no flue guard and a fire sealed within a fireplace.

2.7 FLUE DETAILS - ANALYSIS OF SECTION 7 OF DIDR

The majority of appliances were open flued. There were 76 (80%) which were individual, natural draft and four which were natural draft and used a shared flue. There were also 10 individual room sealed flues, 5 of which were fanned, and 5 flueless appliances. The five which were individual room sealed, fanned flue appliances consisted of four wall mounted boilers and one thermal storage unit. Three had a boiler case which was pressurised by the operation of the fan, and 2 had a depressurised case. Flueing details are given in Figure 17.

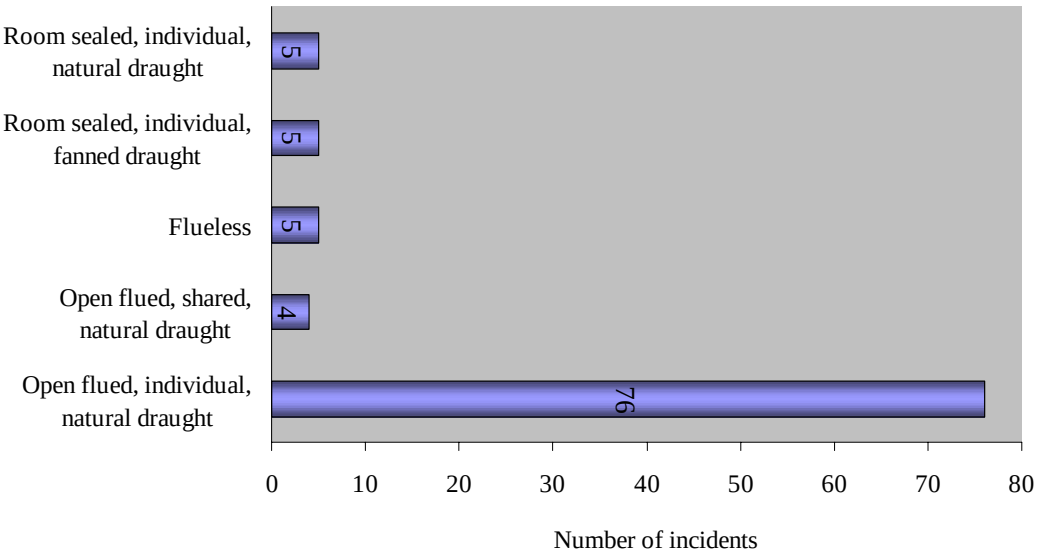

Figure 17 - Incidents by flue type

The analysis of flues to standard, excluding the 5 flueless appliances, is given in Figure 18. There were 51 incidents (57%) where the flue was not to any appropriate standards, 20 (22%) of the flues were to current standards, 14 (16%) were to standards applicable at the time of installation and 5 (5%) where the investigator was unsure/ didn't know.

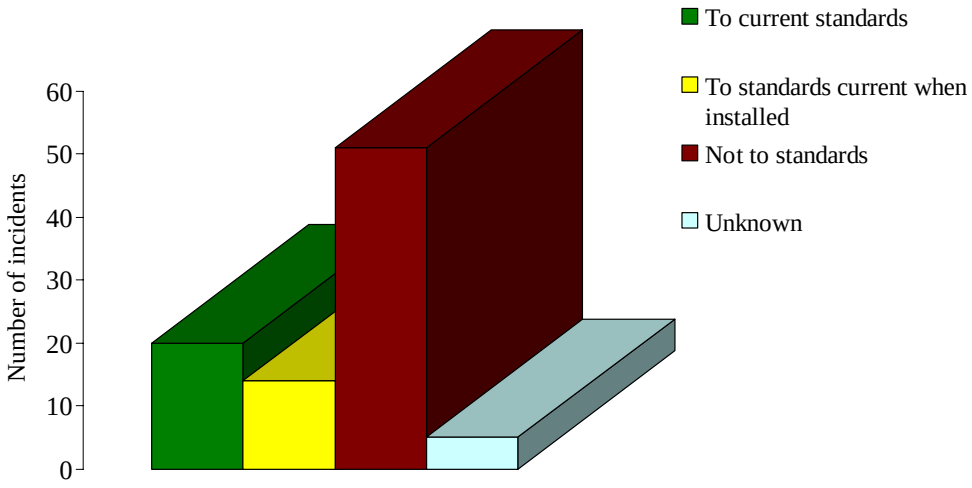

Figure 18 - Flues to standard

The "flue flow and continuity check" was passed by 55 flues and failed by 19. The investigator was unable to carry out this test, or the result was unknown for the remaining 16. The flue was said to be susceptible to "chilling" at 26 incident sites.

Flue liners were reported to have been fitted in 18 cases. In 9 of these cases the liner was fitted at the same time as the appliance, in 2 cases the liner was not fitted at the same time as the appliance and in 7 cases it was not known when the liner was fitted. The liner was said to be fitted within a purpose built chimney at 8 sites, the liner was partially installed within a purpose built chimney at 1 site and it was not within a purpose built chimney at a further 6 sites. It was unknown for the remaining 3.

The number of flueing faults found are given in Table 16 (see section 2.10). A breakdown of the flueing faults, by appliance type, is given in Appendix B. Details of the flue compliance to standards, for each incident appliance, are also given in Appendix B.

> Note: The "flue flow and continuity check" is a visual test generally carried out using a smoke pellet to observe that the flue passes the smoke produced to atmosphere via the flue terminal and with no leakage from the flue. Flues susceptible to "chilling" are likely to have long lengths of external flue, mounted on external walls in positions vulnerable to cold or high winds.

2.8 PERMANENT VENTILATION - ANALYSIS OF SECTION 8 OF DIDR

Permanent ventilation was said to be required in 73 (77%) of the incidents and was not required in the remaining 22 (23%) incidents. Where ventilation was required it had been provided at 57 incidents (78%). The analysis of ventilation provided to standard is given in Figure 19. When provided it was to current standards at 11 installations (19%) and to standards current at the time of installation at 2 installations. It was not to any appropriate standards at 43 installations (75%). The investigator was unsure/didn't know for the one remaining site.

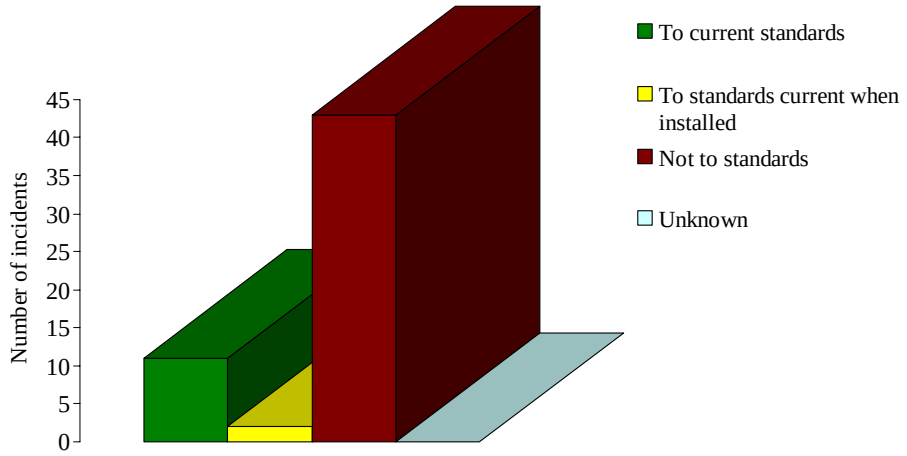

Figure 19 - Ventilation to standard

Where air vents were fitted, and the information was supplied, the air vents were effective and unobstructed at 22 of the incident sites, they were partially obstructed at 12 of the incidents and totally obstructed in 15 incidents. Of those with totally or partially obstructed ventilation 10 were blocked intentionally and 9 unintentionally.

Incident appliances were fitted in compartment/cupboards at 24 incident sites. The compartment/cupboard was to standards applicable at the time of installation in 2 (8%) instances. It was not to standards in 19 (79%) instances. In three cases it was unknown whether the compartment/cupboard met the standards applicable at the time of installation. The analysis of compartment/cupboards provided to standard is given in Figure 20.

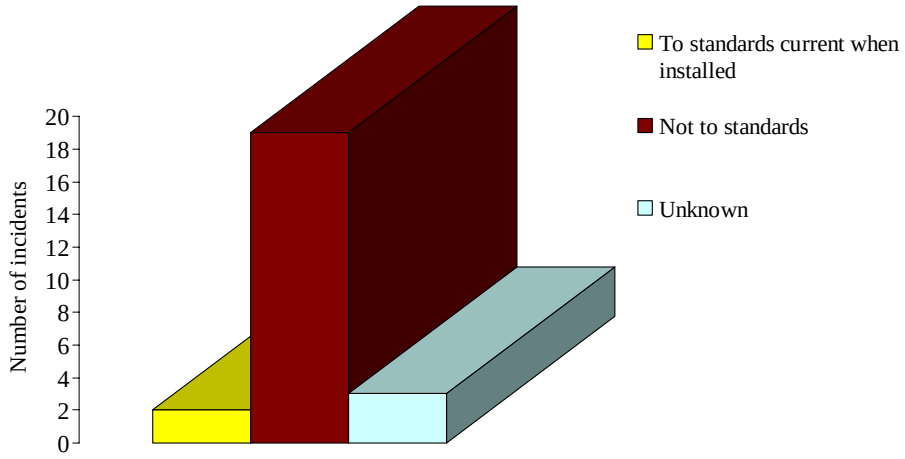

Figure 20 – Compartment/cupboards to standard

Extract fans, recirculating fans, tumble dryers or cooker hoods were reported to have been in use during two incidents.

The number of overall ventilation faults found are given in Table 16 (see section 2.10). A breakdown of the ventilation faults, by appliance type, is given in Appendix B.

2.9 SAFETY DEVICES - ANALYSIS OF SECTION 9 OF DIDR

A total of 15 safety devices were noted as being fitted within the incidents investigated. Eight were downdraught detectors and one was a vitiation device. The remainder were CO alarms consisting of 3 chemical spot detectors and 3 battery powered CO alarms. In only 2 cases was it not confirmed if the safety device was operational. One was a chemical spot detector fitted in a different room to the incident appliance. The other was a battery powered CO alarm which had been loaned to the occupants, but was removed from site before the investigation took place.

2.10 ON-SITE CHECKS - ANALYSIS OF SECTION 10 OF DIDR

The details in Table 16 are for all incident appliances and indicates the total numbers of faults found on these appliances. In Appendix B a breakdown of the information from the DIDR is given by appliance type. The number of faults, by main fault groups, are listed in Figure 21, and Figure 22 shows each individual fault for comparison purposes.

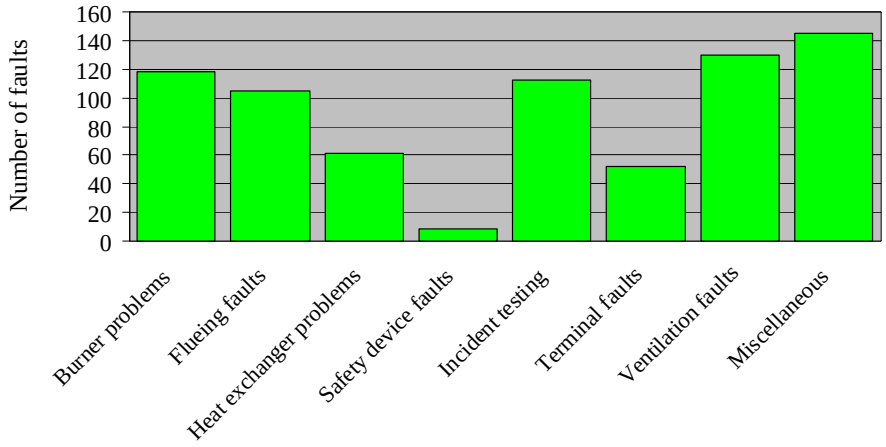

Figure 21 - Main fault groups

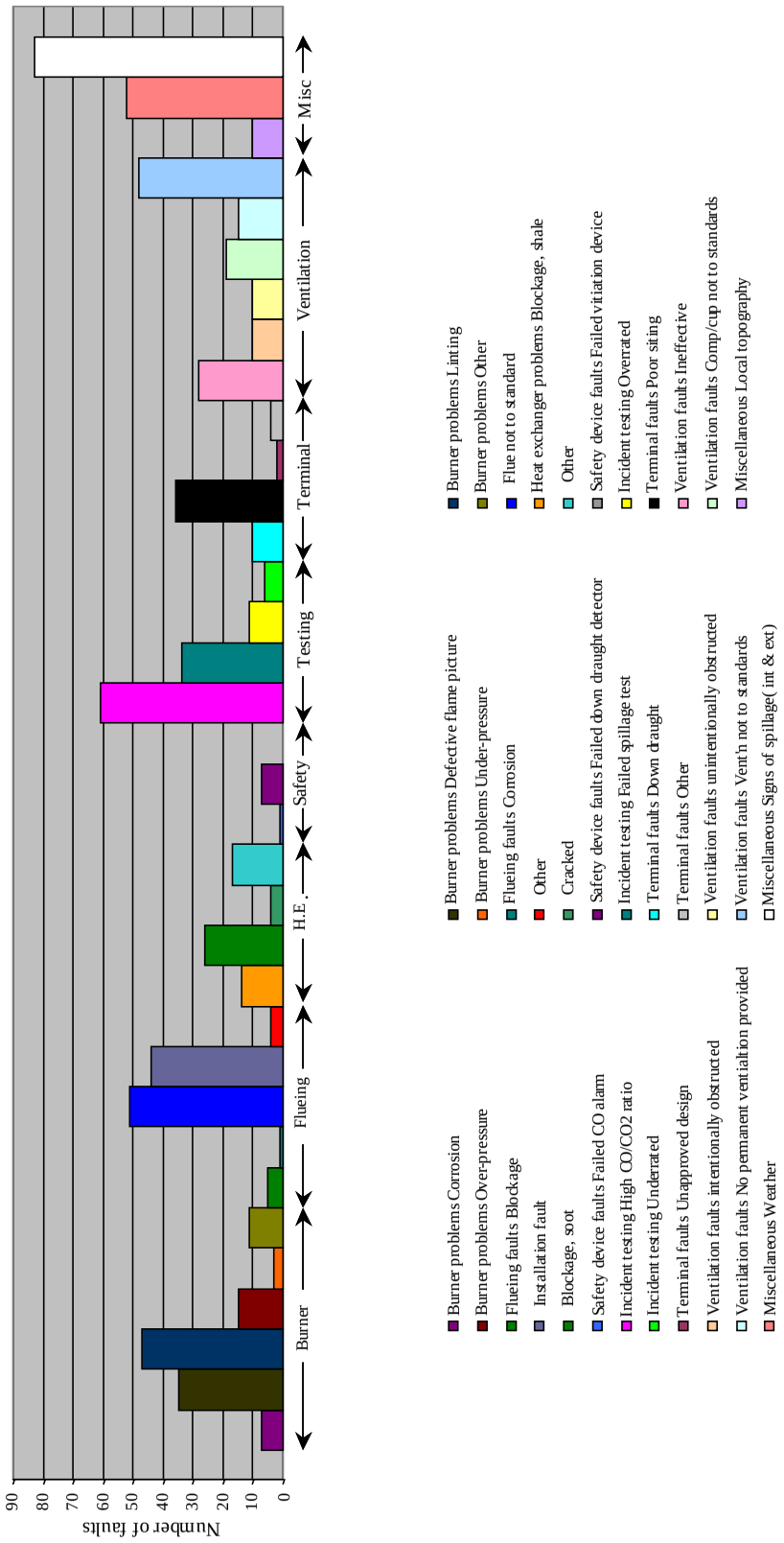

Figure 22 - Individual faults

Table 16 - Incident appliance faults

Fault group	*Number of faults*	*Fault group*	*Number of faults*
Burner		**Incident testing**	
Corrosion	7	High CO/CO2 ratio	61
Defective flame picture	35	Failed spillage test	34
Linting	47	Overrated	11
Over-pressure	15	Underrated	6
Under-pressure	3	**Terminal**	
Other	11	Down draught	10
Flue		Bad siting	36
Blockage	5	Unapproved design	2
Corrosion	1	Other	4
Flue not to any standard	51	**Ventilation**	
Installation fault	44	Air vent/vents ineffective	27
Other	4	Air vents obstructed - intentionally	10
Heat exchanger		Air vents obstructed - unintentionally	9
Blockage - shale	14	Compartment/cupboard not to any standards	19
Blockage - soot	26	No permanent ventilation provided	15
Cracked	4	Ventilation provided was not to any standard	43
Other	17	**Miscellaneous**	
Safety device		Local topography	10
Failed CO alarm	2	Weather	52
Failed down draught detector	0	Signs of spillage – outside the appliance	38
Failed vitiation device	0	Signs of spillage – inside the casing	45

Note: In Table 16 the numbers quoted are the number of appliances found with the fault listed.

In the above table the details of the burner "Other" comments are as follows: Burner distorted, Chilling, Dirty, Lint/dust, Dust in burner, Linted gauze, Double kink in tube to gas valve, Faulty gas valve, Front removed from boiler, Pilot light and Radiants blocked.

The details of the flue "Other" comments are as follows: Flue joints defective, Incorrect flue material, Inner flue had collapsed/leaking outer seal, and Ninety degree bends used/thermal inversion.

The details of the heat exchanger "Other" comments are as follows: Baffles burnt away, Blockage/baffle, Blockage by hard water scale & verdigris, Blockage/fins, Blockage – sulphate, Partial blockage – flaky rust, Dirty (x3), Dirt/distortion, Dirty with slight sooting, Heavy coating of white oxide, Minor shale deposits, Slight debris, Slight sooting/partly blocked verdigris and Seal missing,

The details of the terminal "Other" comments are as follows: Damaged, Incorrect cowl, No terminal guard fitted and No terminal fitted.

There were 7 cases where information was given that the appliance required servicing.

The burner pressure test results indicated that 15 appliances were set high, 3 were set low, 14 were not tested and the remainder were correctly set. The appliance rating test results indicated that 11 appliances were set high, 6 were set low, 15 were not tested and the remainder were correctly set. The CO/CO2 test results indicated 61 appliances were found with a high reading, 17 had a correct reading and in 17 cases the reading could not be taken.

In 55% of cases (52 incidents) CO from the incident appliance was proven to be able to enter the incident property when tested in the as-found condition. For 43 (45%) of these incidents a sufficient concentration of CO was shown to have been produced by the incident appliance which would have been expected to have resulted in the level of COHb found in the victim/victims. In 36 (38%) of incidents it was also indicated that the concentration of CO could be achieved in the available time.

2.11 INCIDENT APPLIANCE SERVICE HISTORY - ANALYSIS OF SECTION 11 OF DIDR

The DIDR returns show that there were 14 incident appliances covered by a regular service contract at the time of the incident. In 68 cases there was no regular service contract and for the remainder details were unknown. Analysis of the number of tick boxes completed for the "last working visit" is given in Table 17.

Table 17 - Details of the last working visit

Last working visit by:	*Number of tick-boxes completed*
CORGI fitter	31 (33%)
Non-CORGI fitter	4 (4%)
Other	2 (2%)
Unknown	58 (61%)

The two listed as "other" were a local engineer and the owner. Analysis of the number of tick boxes completed for the "reason for the visit" is given in Table 18.

Table 18 - Reason for the last working visit

Reason for visit:	*Number of tick-boxes completed*
Breakdown	10 (11%)
Report of fumes	3 (3%)
Safety check/inspection	6 (6%)
Service	25 (26%)
To install the incident appliance	2 (2%)
Other	5 (5%)
Unknown	44 (47%)

The five listed as "other" were: building work, failed landlord safety check 3 months prior to incident, to carry out a safety check and extend the flue pipe, to carry out a service and fit parts and serviced prior to investigation. Analysis of the number of tick boxes completed for the time period involved between the last working visit and the incident is given in Table 19.

Table 19 - Interval between the last working visit and the incident

Time between the last working visit and the incident	*Number of tick-boxes completed*
Less than 6 months	24 (25%)
6 months to 1 year	10 (11%)
1 year to 2 years	14 (15%)
More than 2 years	12 (13%)
Unknown	33 (34%)
Not applicable	2 (2%)

Investigation of the 14 sites where regular servicing was said to be carried out showed the last working visit was by CORGI registered fitters in 13 cases and by an "unknown" fitter on one occasion. The reasons for the visits were servicing (8), safety check (4), breakdown (1) and "other" reasons (1). The "other" reason given was to carry out a safety check and extend the flue pipe.

Analysis of who attended to carry out the last working visit is as follows: Breakdowns were dealt with by 3 CORGI registered fitters, 1 non-CORGI registered fitter, 5 unknown fitters and 1 "other" who was listed as the owner. Fume reports were dealt with by 1 CORGI registered fitter and 2 unknown fitters. Safety checks/inspections were all dealt with by 6 CORGI registered fitters. Servicing was dealt with by 14 CORGI registered fitters, 2 non-CORGI registered fitters, 8 unknown fitters and 1 "other" who was listed as a local engineer. Installing the incident appliance was dealt with by 2 CORGI registered fitters.

2.12 HISTORICAL INFORMATION - ANALYSIS OF SECTION 12 OF DIDR

A safety warning notice had been attached to the incident appliance or at the gas meter prior to the incident on 6 occasions. It was legible at 5 of the sites. The notes were as follows: Failed landlords safety check, Transco "Do Not Use" label, Transco label, Unsafe situation – meter and a Ventilation notice issued in 2000.

Prior to the incident, the incident appliance had been inspected, following reports of fume spillage, in 7 incidents. There were 5 reports of incident installations having been inspected following reports of fume spillage. The occupants reported experiencing symptoms typically associated with CO poisoning at 15 incident sites. There were 3 reports indicating that the incident appliance/installation had been previously disconnected following reports of fume spillage.

2.13 INCIDENT CAUSE/CAUSES - ANALYSIS OF SECTION 13 OF DIDR

Details of the established cause/causes of all the incidents are summarised in Table 20. There were multiple entries on some DIDR forms in this section. This results in the total number of causes given exceeding the total number of incidents.

Table 20 – Incident causes

Incident cause (s)	*Total number recorded*
Appliance fault	13
Appliance installation fault	6
Customer misuse of the appliance	4
Flue/terminal fault	36
Lack of servicing	48
Sub-standard compartment	9
Sub-standard servicing	6
Ventilation fault	22
Not known/not yet established	4
Other	7

The causes indicated under “Other” were as follows: Boiler enclosed, Cavity wall insulation, Interference, Vitiation, Water in pipes and Weather (2). Within section 2.10, it also lists that the weather contributed to the poor performance of the appliance in 52 incidents, and local topography featured in 10 incidents.

3 GENERAL DISCUSSION

This is the fifth analysis of CO incident information provided by the use of the DIDR form within the gas industry.

The types of incidents featured in 2000/01 were much the same as in previous years. The majority of incidents (76 out of 95) involved open, individual, natural draught flued appliances. There were 10 involving room sealed appliances, 4 involving open flued, shared, natural draught appliances and 5 involving flueless appliances. Central heating appliance incidents resulted in 87% of the total number of fatal and non-fatal casualties. The next highest appliance group was space heaters at 5%, followed by cookers at 3%. In terms of the number of fatalities, by appliance types, central heating appliances also led to the majority at 81%, with space heaters responsible for the remaining 19%.

In addition to the domestic incidents reported above, there were five LPG domestic incidents reported involving 5 fatalities (a detailed breakdown is given in Appendix C) and 2 non-domestic incidents involving 1 fatality (a detailed breakdown is given in Appendix D).

3.1 INCIDENT DETAILS

The number of domestic CO incidents fully investigated, reported and analysed in this report was 95. The majority of these incidents took place during the heating season, which is in line with previous records. Figure 1 shows a very similar profile in each of the previous reports issued.

Study of the postcode areas in which the incidents occurred show that only two codes featured with 2 exact matches. These were FY1, the Fylde (Blackpool) Post Town area and LN5, the Lincoln Post Town area. When analysed by Post Towns there were 7 incidents in Birmingham, 6 in London, and 3 in each of the following: Bournemouth, Coventry, Northampton, Norwich and Uxbridge.

3.2 CASUALTY DETAILS

The total number of incidents reported, at 95, was within the range of incidents reported as part of this series of reports and the historical data presented. For the years 1993/94 to 2000/01 the total number of incidents reported falls within a band of 85±22. From Figure 4 it is not possible to state if there is any trend in the number of reportable CO incidents being investigated. The value of the total IPPY value for 2000/01 is similar to previous years values at 2.09×10^{-6} and falls within the band of $1.845 \pm 0.455 \times 10^{-6}$ obtained between the years 1993/94 to 1999/00.

The total number of fatalities reported, at 16, was the lowest number recorded within the range of fatalities reported as part of this series of reports. The previous minimum had been 22 in 1997/98 and for the years 1993/94 to 1999/00 the number reported had been 26.5±4.5. The data shown in figure 3 indicates a reduction in the number of annual CO fatalities that are being reported. The total FPPY figure of 0.35×10^{-6} is the lowest figure calculated during the reporting periods covered since 1993/94. This value of FPPY falls within, what would normally be considered as, the "broadly accepted region" of HSE's criteria for the tolerability of risk. However, societal concerns over gas safety override averaged numerical considerations.

Non-fatal casualties recorded, at 233, were the highest number reported as part of this series of reports. Between 1993/94 and 1999/00 the range had been 176±55. It is too early confirm if this trend indicates a general increase in the number of non-fatal casualties, but the numbers have been particularly high in the last 3 out of 4 years. The most serious casualties (in group N1, where casualties spent over 24 hours in hospital) were recorded at 28 persons for 2000/01. This indicates a number midway in the range recorded over the preceding 3 years of 20, 49 and 16. The value of the total CPPY value is also the highest figure calculated during the reporting periods from 1993/94 onwards.

The casualty age profile, shown in figure 5, shows close similarity with the figures given in the previous three reports of this series. In relation to the age profile of the resident population of the United Kingdom for 1999, obtained from the office for National Statistics, the graph indicates that those above the 30 to 40 age band feature less in incidents than would be expected, and those below the 30 to 40 age band feature more than would be expected. The 0 to 10 age band exhibits the largest variation, by approximately 45% above what would be expected.

The conclusions are that during 2000/01 a typical number of incidents were fully investigated and reported on the DIDR form, but that these incidents resulted in above average numbers of non-fatal casualties and below average numbers of fatalities.

3.3 INCIDENT LOCATION DETAILS

From the figures on occupancy quoted in section 2.3 it can be seen that there were more incidents within owner occupied properties than in tenanted properties. This is in line with previous reports. The proportion of incidents in each occupancy group is also broadly in line with the occupancy statistics for England, but when a relative risk analysis is carried out it indicates that tenanted/privately owned accommodation is the area of greatest relative risk. Tenanted/privately owned accommodation also featured as the highest relative risk category in the past 4 reports.

Relative risk factors (based on a division of the percentage split of DIDR reported incidents for that group by the national percentage of occurrences of that group - 100 being the overall average factor, and using the figures quoted in section 2.3) show that the tenanted/council group has a relative risk factor of 79. This was calculated as follows ((11/14) x 100) = 79. In comparison owner occupied properties have a relative risk factor of 94, the tenanted/registered social landlord group has a relative risk factor of 50 and tenanted/privately owned accommodation has a relative risk factor of 170.

The analysis shows that tenanted/privately owned accommodation is the area of greatest relative risk, followed by owner occupied properties. Tenanted/council and tenanted/registered social landlord properties show the lowest relative risks.

Incidents took place more often in terraced properties during the period 1996/97 to 1999/00 and this trend continued during 2000/01. The numbers taking place in flats has reduced during 2000/01, whereas the numbers taking place in detached and semi-detached properties is similar to previous results.

As in previous years, the number of incidents that took place across all property types is not in broad agreement to the proportions of each type of property within England. This is shown in Table 5. For 1999/00 (the most recent statistics available) the accommodation statistics and other national statistics used in this report have become segregated due to devolution. The values for England are now used within this report due to their close agreement with previous British statistics.

There have been variations noted which affect each property style identified in Table 5. Looking at the 5 reports in this series, the incidents in all flats and maisonettes did occur initially above that expected from comparison with accommodation statistics by 5%. During 1999/00 this had dropped to 1% above that expected, and for 2000/01 the property style is 5% below its expected accommodation proportion.

Incidents in detached and semi-detached properties previously featured below expected levels. For semi-detached properties the level of incidents during 2000/01 was similar to previous results at 0.7 times below expected levels. Detached properties have slowly changed, over the 5 years reported, from being below expected levels to now being in line with expected levels.

Terraced properties were the only property style that featured with incidents above that expected from a comparison to the proportions of each type of property within England. The number of incidents taking place in terraced houses/bungalows was 1.6 times more than would be expected, if the results were independent of property type, during 2000/01. Looking at previous years, this ratio has been slowly increasing. The reasons why these changes have taken place to the different property groups is unclear and is beyond the scope of this report.

Where the age of the incident property was specified, it is the older properties (i.e. pre 1945) that are seen to feature more often in incidents comprising 51% of the total. This proportion of incidents is not inline with the age profile of properties in England. The proportion of incidents taking place in older properties is 30% more than expected and those built from 1966 onwards are 30% less than expected. The trend noted in previous reports was for incidents to occur more often than expected in pre 1945 properties, except for the 1999/00 report, where properties built between 1946 and 1965 were the group that featured in an above average number of incidents.

3.4 CASUALTY & APPLIANCE LOCATION

The majority of appliances that led to incidents were, as in previous years, located in the kitchen of the incident sites. The next most common areas were the living room/lounge and the hall. These locations are very much as would be expected for the majority of domestic gas appliances. However, the greatest numbers of casualties were located in the bedroom and the living room/lounge. Appliances located in other rooms affected almost all the casualties in the bedroom and the majority of those in the living room/lounge. All of incidents, where details were completed, showed they took place with the casualties and incident appliance in the same property. In only 6 incidents were the details not coded.

Analysis of the floor on which incident appliances were located shows that, as would be expected, the majority were on the ground floor, where most kitchens are located. Information is not available for how many of the total appliance population are installed in compartments, but it is likely to be a significantly lower percentage than the number of incident appliances located in compartments (25%).

3.5 INCIDENT APPLIANCE DETAILS

The total number of incidents was made up of 79 incidents involving central heating boilers, 3 incidents involving cookers, 10 involving space heaters and 1 involving a water heater. These figures are very similar to those given in the previous four annual reports, as described in Table 21. As previously reported, central heating boilers were involved in the majority of CO incidents and were responsible for the majority of casualties.

Table 21 - Trend data of incident occurrences

Appliance	*Year*				
	1996/97	*1997/98*	*1998/99*	*1999/00*	*2000/01*
C/H Boilers	54 (81%)	70 (72%)	79 (74%)	51 (81%)	79 (83%)
Cookers	5 (7%)	6 (6%)	7 (6%)	6 (10%)	3 (3%)
Space Heaters	5 (7%)	16 (17%)	18 (17%)	4 (6%)	10 (11%)
Water Heaters	1 (2%)	5 (5%)	3 (3%)	2 (3%)	1 (1%)
Other	2 (3%)	0 (0%)	0 (0%)	0 (0%)	2 (2%)
Grand Total	**67**	**97**	**107**	**63**	**95**

The fatality trend table (Table 12) indicates that natural gas appliances are responsible for a reducing number of fatalities over the eight-year period. In 2000/01 floor standing and wall mounted boilers were responsible for most fatalities, at 4 each. The next largest groups were wall mounted combi boilers and radiant/radiant convector gas fires, with 3 fatalities each. Central heating boilers appear to be responsible for a similar number of fatalities each year, whereas cookers and space heaters numbers are more variable. The level of fatalities recorded for 2000/01 was particularly low, with for the first time no fatalities due to cookers or water heaters.

No appliances had a FPPY risk value that was above what would normally be considered as the "broadly accepted region" of HSE's criteria for the tolerability of risk (1×10^{-6}). Looking at all the appliance risk values in Table 11 it can be seen that warm air units had the highest risk, with a FPPY value of 0.73×10^{-6} during 2000/01.

The majority of non-fatal casualties continue to be related with central heating boilers. The number of non-fatal casualties associated with all central heating boilers is about 16 times the number of fatalities that took place. During the previous four years this ratio has ranged between 7 and 39, and this year the value is very close to the average obtained for the five year period. Wall mounted boiler incidents were responsible for the highest number of non-fatal casualties, followed by floor standing boilers and wall mounted combi boilers. Wall mounted boilers were not the highest risk though, when looking at the CPPY values in Table 11, where single-point water heaters, at 10.41×10^{-6} are the highest risk, followed by floor standing boilers at 8.21×10^{-6}. During 2000/01 there were 4 non-fatal casualties related to the use of single-point water heaters and in two previous annual reports this appliance also featured as the highest CPPY risk. Reasons for the high risks associated with this appliance have featured in previous annual reports.

For 2000/01 floor standing boilers were the highest IPPY risk (3.35×10^{-6}) followed by single-point water heaters (2.60×10^{-6}). The IPPY values for single-point water heater incidents have ranged over the 5 reporting years between 11.7×10^{-6} in 1997/98 and 2.6×10^{-6} in 2000/01, with an average value of 5.2×10^{-6}. The IPPY risk values for single-point water heaters have reduced yearly since the value in 1997/98 to its lowest value of 2.6×10^{-6} in 2000/01.

There were no reports of any incidents involving condensing appliances or tumble dryers during this reporting period, or in the previous four years already reported, even though they are now becoming more common in domestic properties. Condensing boilers have modern safety features and controls with a room sealed, balanced flue so it would be expected that they will continue to rarely feature in CO incident reports. Tumble dryers also have modern safety controls and a low gas input rate and with only a small installed population, they are also likely to rarely feature in CO incident reports.

In line with previous results, many installations feature sub-standard flueing and ventilation in addition to a lack of servicing. In a number of cases the installation itself was at fault, rather than the appliance. Data on the age of incident appliances is often not coded but, where provided, it was mainly for central heating boilers and showed that the risk was spread across the typical appliance age range.

3.6 APPLIANCE INSTALLATION DETAILS

As would be expected, the information available shows that the majority of appliances are new when installed. The installation period for incident appliances includes a similar amount of data to that given in Table 10 – Age of incident appliances, and the very limited provided shows that 6 to 15 year old appliance installations provide the highest risk.

In 85% of the incidents, the appliances had been installed correctly and to the relevant standards. In the majority of cases where the appliance was not fitted to standard it was by an "unknown person". In only 3 incidents was it known that the appliances had been installed second-hand and in no incidents was it reported that the appliance was fitted by DIY persons. In the majority of incidents, information was not forthcoming on whether the appliance was bought new or who fitted the appliance.

3.7 FLUE DETAILS

As in previous years the majority of incidents involved open flued appliances (84%). Approximately 57% (51) of all flues fitted were not installed to appropriate standards and in 49% (44) of all incidents where a flue was fitted, the flue had an installation defect. Flue blockage had taken place in 5 (6%) incidents where a flue was fitted. When checked by a flue flow and continuity check, 26% of flues failed the check. There were 36 flue terminals reported to be badly sited and 10 flues that were liable to suffer from downdraught problems. Basic flue and terminal installation faults should be picked up during routine servicing of open flue appliances, so this is an area where the service engineer requires continued diligence.

The weather was thought to contribute to the poor performance of the appliance in 52 incidents. This is a common factor in CO incident reports, as most incidents occur during the cold and/or windy months of the year. In fact peak numbers of incidents are often noted on the coldest days of the winter, and when a cold northerly or easterly wind is experienced there is often an increase in the numbers of CO incidents.

3.8 PERMANENT VENTILATION

In many incidents during the reporting period, the permanent ventilation required had not been provided, or it was not to standards and/or had become restricted. Such factors can affect flue performance and, in combination with other faults, are generally acknowledged to contribute towards the causes of CO incidents. As a common fault at incident sites this is an item that can be improved by continued customer awareness campaigns and during routine servicing. Details of the numbers of ventilation faults noted at incidents are given in Table 16 within section 2.10.

It has been noted in previous reports that incident appliances installed in compartments feature in a higher percentage of incidents than expected. The results of this analysis show that, of the 24 incident appliances located in compartments, almost all (19) of these compartments were not to relevant standards. The typical faults found should be apparent during routine servicing to qualified service engineers. Ventilation faults are relatively simple to identify and cure, but if open flued appliances are to continue in use their safe operation needs to be checked annually and any ventilation faults corrected.

3.9 SAFETY DEVICES

There are a slowly increasing number of safety devices being noted at incident sites, and in the majority of cases they appear to be in working order. The numbers in use, however, are still likely to be very small when compared to the total numbers of gas appliances installed. At no sites during this reporting period was it recorded that a safety device was non-operational.

3.10 ON-SITE CHECKS

A combination of factors were present at most incident sites, with several separate occurrences probably leading to the production of CO, particularly a combination of flue and ventilation faults. It was found that often there were similar faults on the appliances i.e. the appliance had a high CO/CO2 ratio and was spilling products, there was a defective flame picture and linting had also taken place. These were the most common faults noted from the on-site checks and which should be addressed during routine servicing. Details of the numbers of faults noted at incidents are given in Table 16 within section 2.10. To a greater or lesser extent, almost all of the faults listed on the DIDR form have taken place somewhere and have been discovered during an investigation.

There were signs of spillage on the outside of the appliance which would be apparent to the occupants at 38 sites. It can be concluded that the need for annual servicing and raising awareness of the signs of poor operation of gas appliances are matters that need to be continually brought to the attention of gas users.

3.11 INCIDENT APPLIANCE SERVICE HISTORY

From the information provided only 14 of the 95 incident appliances were covered by a regular service contract, and the conclusion from this section of the report is that it is likely that the majority of incident appliances are not regularly serviced. Where appliances were said to be on a regular service contract it was generally carried out by a CORGI fitter.

Details of who made the last working visit to attend to the incident appliance are not provided at many incidents. There could be several reasons for this, but it is likely that servicing is so irregular that customers have not established any long term contact with any particular servicing agency. This is also implied when looking at the data relating to the interval between the last working visit and the incident.

3.12 HISTORICAL INFORMATION

Details entered in this section indicated only a small proportion of incidents featured appliances or installations which had previously been suspected of fume spillage. When questioned, occupants at 16% of incident sites said they had experienced symptoms that are typically associated with CO poisoning. It would be expected that, at most CO incidents, the levels of CO produced by the incident appliance would build up progressively over a period of time. The reasons and situations why occupants seem to be only seriously affected above a threshold value, and on a particular day, are beyond the scope of this report, but what can be shown is that many typical faults are found at incident sites and that, by addressing these, many incidents can be avoided.

3.13 INCIDENT CAUSE/CAUSES

Details of the incident causes, given by the investigators, highlight particularly that a lack of servicing and flue/terminal faults are the most common causes identified. The weather is also identified in a similar number of incidents. Ventilation faults are the next most common cause. This information confirms details already given within this report, which indicate that a substantial number of CO incidents could be avoided by regular, thorough safety checks and/or servicing.

4 SUMMARY

4.1 The number of domestic related CO poisoning deaths reported, at 16 during 2000/01, was the lowest recorded since 1993/94.

4.2 The over-all FPPY figure of 0.35×10^{-6} is within, what would normally be considered as, the "broadly accepted region" of HSE's criteria for the tolerability of risk. However societal concerns over gas safety override averaged numerical considerations.

4.3 There were no appliance types that were above the HSE's criteria for the tolerability of risk.

4.4 There was an above average risk of a CO incident in tenanted accommodation that was privately owned.

4.5 The most common room location for casualties was in the bedroom and the living room/lounge.

4.6 The majority of all CO incidents involved open flued, individual, natural draught appliances.

4.7 Central heating appliances were responsible for the majority of fatal and non-fatal casualties.

4.8 The most common incident causes were a lack of servicing and flue/terminal faults.

4.9 Flueing and ventilation faults were common in many domestic incidents.

4.10 There were 5 LPG and 2 non-domestic incidents reported during 2000/01.

5 CONCLUSIONS

Analysis of the CO incident statistics, collected from the Downstream Incident Data Report form, has produced results in line with previous years results. The analysis identifies the most common faults found at incidents. This information can be used to improve customer safety, target expenditure on CO incident prevention and further research work.

6 RECOMMENDATIONS

6.1 The continuing importance of collecting and analysing incident statistics needs to be stressed. Without this information the risks associated with appliances, installations etc, cannot be accurately assessed and acted upon.

6.2 The data should be made available to all interested parties, i.e. those concerned with the safety, transportation and supply of gas and also to those involved in the installation and maintenance of gas appliances.

7 DATA USED AND REFERENCES

7.1 DATA USED

7.1.1 Appliance Population Statistics - Statistics for Great Britain provided by GfK Marketing Services Ltd., Sheer House, Station Approach, West Byfleet, Surrey KT14 6NL.

7.1.2 Historical Incident Data - Advantica database.

7.1.3 Number of Natural Gas Customers - Best estimates, for Great Britain, obtained from Lattice Group plc company records.

7.1.4 Population & Housing Statistics for England - The size of the average household has been calculated from figures produced by the Office for National Statistics and published in the Annual Abstract of Statistics. Housing data has been obtained from the Survey of English Housing published by the Department for Transport, Local Government and the Regions.

7.2 REFERENCES

7.2.1 Definitions of FPPY, CPPY and IPPY (see Appendix A) - Advantica Reports.

APPENDIX A DEFINITIONS AND THE USE OF FPPY, IPPY AND CPPY VALUES

a) Fatalities Per Person Per Year (FPPY)

FPPY is a measure of the risk of death from owning a specific appliance type.

FPPY is defined as:-

$$FPPY = \frac{\text{Number of Fatalities}}{\text{Number of people at risk x Appliance Population}}$$

Notes:

1) In the report the number of people at risk is taken as the average number of people per household (2.26 in 2000/01). - provided from Government Statistics - see report section 7.

2) The "Overall FPPY" is calculated, as above, except that "Appliance Population" is replaced by the number of customers - see report section 7.

3) The appliance population figures used have been taken from information provided by GfK Marketing Services- see report section 7.

b) Incidents Per Person Per Year (IPPY)

IPPY is a measure of the risk of having an accident with a specific appliance type.

IPPY is defined as:-

$$IPPY = \frac{\text{Number of Incidents}}{\text{Number of people at risk x Appliance Population}}$$

c) Casualties Per Person Per Year (CPPY)

CPPY is a measure of the risk of being injured by owning a specific appliance type.

CPPY is defined as:-

$$CPPY = \frac{\text{Number of Casualties}}{\text{Number of people at risk x Appliance Population}}$$

APPENDIX B TABLES, BY APPLIANCE TYPE, SHOWING THE NUMBER OF FAULTS AND INDIVIDUAL INCIDENT DETAILS

Table B/A1 shows the breakdown of tables included in this Appendix. They have been completed for the appliance groups only where there were relevant incident appliances to describe. The appliance groups have been ordered in the same way as that used in section 2.5.2 of the report and within Table 9.

The nomenclature adopted allows data to be presented for any of the appliance groups. This has the advantage that tables with the same code may be readily identified, which can aid the comparison on a year-by-year basis. However, groups may not have been implicated in incidents in any particular year, so they are indicated in this appendix as “no reported incident”.

Table B/A1 – Summary of incident fault analysis and summary tables presented

Appliance group	*Appliance sub-group*	*Code*	*Incidents*	*Appendix tables*
Central Heating Boilers	Back boiler unit	1.1	7	B.1.1a & b
	Floor standing	1.2	20	B.1.2a & bi-ii
	Floor standing combi	1.3	0	No reported incident
	Thermal storage unit	1.4	1	B.1.4a & b
	Wall mounted	1.5	27	B.1.5a & bi-ii
	Wall mounted combi	1.6	19	B.1.6a & b
	Warm air unit	1.7	5	B.1.7a & b
	Other	1.8	1	B.1.8a & b
Cookers	Free standing	2.1	3	B.2.1a & b
	Built-in oven	2.2	0	No reported incident
	Built-in hob	2.3	0	No reported incident
	Other	2.4	1	B.2.4a & b
Space Heaters	Balanced flue g .f.	3.1	0	No reported incident
	Cabinet heater	3.2	0	No reported incident
	Decorative g .f.	3.3	0	No reported incident
	Flueless heater	3.4	0	No reported incident
	Inset live fuel effect g .f.	3.5	1	B.3.5a & b
	Rad. & rad. con. g .f.	3.6	9	B.3.6a & b
	Wall heater	3.7	0	No reported incident
	Other	3.8	0	No reported incident
Dryers	Tumble Dryers	4.1	0	No reported incident
Water Heaters	Bulk storage	5.1	0	No reported incident
	Circulator	5.2	0	No reported incident
	Multi-point	5.3	0	No reported incident
	Single-point	5.4	1	B.5.4a & b
	Other	5.5	0	No reported incident

In addition, these codes have been used within the tables in this appendix :

Table B/A2 – Appliance location and flue type codes

Appliance location	*Code*	*Flue type*	*Code*
Other	0	Other	0
Bathroom	2	RS/Indiv/Natural draught/BF	1
Bedroom	3	RS/Shared/Se-duct	3
Bedsit	4	RS/Shared/U-duct	4
Dining Room	6	Open/Indiv/Natural draught	5
Utility Room	7	Open/Indiv/Fanned/Integral	6
Garage	8	Open/Indiv/Fanned/Add on	7
Hall	9	Open/Shared/Natural draught	8
Kitchen	10	Open/Shared/Fanned draught	9
Landing	11	Closed	10
Living Room/Lounge	12	Flueless	11
Shower room	13	Unbalanced	12
		RS/Indiv/Fanned draught/depressurised case	21
		RS/Indiv/Fanned draught/pressurised case	22

Table B/A3 – Cause of incident codes

Cause of incident	*Code*
Other	0
Appliance fault	1
Appliance installation fault	2
Customer misuse of the appliance	3
Flue/terminal fault	4
Lack of servicing	5
Sub-standard compartment	6
Sub-standard servicing	7
Ventilation fault	8
Not known/not yet established	9

B.1 CENTRAL HEATING BOILERS

B.1.1 BACK BOILER UNIT

Table B.1.1a - Central heating boilers : back boiler unit : Summary fault analysis

number of incidents=7

Fault group	*Number of faults*		*Fault group*	*Number of faults*
Burner			**Incident testing**	
Corrosion	1		High CO/CO_2 ratio	6
Defective flame picture	5		Failed spillage test	2
Linting	5		Overrated	1
Over-pressure	2		Underrated	0
Under-pressure	0		**Terminal**	
Other	0		Down draught	0
Flue			Bad siting	1
Blockage	1		Unapproved design	0
Corrosion	0		Other	0
Flue not to any standard	2		**Ventilation**	
Installation fault	2		Air vent/vents ineffective	1
Other	0		Air vents obstructed - intentionally	1
Heat exchanger			Air vents obstructed - unintentionally	0
Blockage – shale	1		Compartment/cupboard not to any standards	0
Blockage – soot	5		No permanent ventilation provided	1
Cracked	0		Ventilation provided was not to any standard	0
Other	0		**Miscellaneous**	
Safety device			Local topography	0
Failed CO alarm	0		Weather	2
Failed down draught detector	1		Signs of spillage – outside the appliance	4
Failed vitiation device	0		Signs of spillage – inside the casing	3

Table B.1.1b - Central heating boilers : back boiler unit : Incident summary

Post Code	*Number of casualties: fatal (non-fatal)*	*Appliance age (yrs)*	*Appliance location*	*Installer*	*Flue to standards*	*Ventilation to standards*	*Appliance make & model*	*Flue type*	*Incident cause(s)*
S70	(4)		12	Unknown			Glow-Worm Housewarmer	5	5
CV37	(1)		12	Unknown	Current		Glow-Worm 246	5	5
UB2	(4)		12	Unknown	Current when installed	Current	Glow-Worm 56	5	5
UB3	(3)		12	Unknown	Current when installed	Current	Baxi Bermuda 552	5	4,7
DY5	(4)		12	Unknown		Current	Myson Housewarmer 45 Electronic	5	2,4,5
NR32	(1)		12	Unknown	Current	Current	Baxi Bermuda GF50	5	5
L21	(1)	21	12	Unknown	Current when installed	Current	Thorn Housewarmer E	5	5

B.1.2 FLOOR STANDING BOILER

Table B.1.2a - Central heating boilers : floor standing boiler : Summary fault analysis

number of incidents=20

Fault group	*Number of faults*		*Fault group*	*Number of faults*
Burner			**Incident testing**	
Corrosion	2		High CO/CO_2 ratio	12
Defective flame picture	3		Failed spillage test	6
Linting	10		Overrated	2
Over-pressure	2		Underrated	1
Under-pressure	0		**Terminal**	
Other	1		Down draught	3
Flue			Bad siting	11
Blockage	1		Unapproved design	0
Corrosion	0		Other	1
Flue not to any standard	12		**Ventilation**	
Installation fault	10		Air vent/vents ineffective	9
Other	1		Air vents obstructed - intentionally	2
Heat exchanger			Air vents obstructed - unintentionally	4
Blockage - shale	2		Compartment/cupboard not to any standards	8
Blockage - soot	5		No permanent ventilation provided	2
Cracked	0		Ventilation provided was not to any standard	18
Other	5		**Miscellaneous**	
Safety device			Local topography	4
Failed CO alarm	1		Weather	16
Failed down draught detector	3		Signs of spillage – outside the appliance	5
Failed vitiation device	0		Signs of spillage – inside the casing	7

Table B.1.2bi - Central heating boilers : floor standing boiler : Incident summary

Post Code	*Number of casualties: fatal (non-fatal)*	*Appliance age (yrs)*	*Appliance location*	*Installer*	*Flue to standards*	*Ventilation to standards*	*Appliance make & model*	*Flue type*	*Incident cause(s)*
SM6	(1)		10	Unknown	Current when installed		Potterton Diplomat 30/34	5	5
HP12	(1)		9	Unknown			Ideal Mexico CF 40/60	5	1
B45	(1)	20	10	Unknown	Current		Thorn Myson M42	5	5
NG31	1 (2)		10	Unknown	Current		Glow-Worm Hideaway 60	5	6,8,0
LN5	(4)		10	Unknown			Vulcan Continental 45/60	5	4,5,8
L25	(2)		10	CORGI			Vulcan/Continental 45/60	5	0
RG2	(5)		0	Unknown			Ideal/Stelrad Concord CX275/E10	5	4
GL7	(6)		7	Unknown			Ideal Stelrad Mexico Super 2 CF80	5	4,7,0
SS9	(4)		7	Unknown			Potterton Kingfisher CF60	5	4,5,6,8
BH8	(1)		3	Unknown	Current		Myson Marathon 50B	1	1

Note: The incident cause code 0 was described as “Boiler enclosed” at NG31, “Cavity wall insulation” at L25 and “Water in pipes” at GL7.

Table B.1.2bii - Central heating boilers : floor standing boiler : Incident summary

Post Code	*Number of casualties: fatal (non-fatal)*	*Appliance age (yrs)*	*Appliance location*	*Installer*	*Flue to standards*	*Ventilation to standards*	*Appliance make & model*	*Flue type*	*Incident cause(s)*
KA7	(4)		10	Unknown	Current when installed		Ideal Mexico Super 2 CF125	5	4,8
B65	(2)		9	Unknown			Potterton Kingfisher	5	4,5,6,8
DA4	1 (1)		10	Unknown			Potterton Kingfisher CF60	5	5
SE25	(1)		10	Unknown			Potterton Kingfisher CF60	5	5
EN6	(2)		10	Unknown		Current	Potterton Kingfisher CF60	5	4
SO41	(2)	25	10	CORGI			Ideal Standard E Type 50CF	5	0
S41	(3)	32	3	Unknown	Current when installed		Potterton Myson C80/23	5	9
BB8	(5)		10	Unknown			Potterton C40/12/BE	5	5
CT9	(2)		9	Unknown			Potterton Kingfisher CF50	5	4,6,8
TN13	2	17	9	Unknown	Current when installed		Thorn M44/54C	5	8

Note: The incident cause code 0 was described as “Weather” at SO41.

B.1.3 FLOOR STANDING COMBI – NO REPORTED INCIDENT

B.1.4 THERMAL STORAGE UNIT

Table B.1.4a – Central heating boilers : thermal storage unit : Summary fault analysis

number of incidents=1

Fault group	*Number of faults*		*Fault group*	*Number of faults*
Burner			**Incident testing**	
Corrosion	0		High CO/CO_2 ratio	1
Defective flame picture	1		Failed spillage test	0
Linting	0		Overrated	1
Over-pressure	0		Underrated	0
Under-pressure	0		**Terminal**	
Other	0		Down draught	0
Flue			Bad siting	0
Blockage	0		Unapproved design	0
Corrosion	0		Other	0
Flue not to any standard	0		**Ventilation**	
Installation fault	0		Air vent/vents ineffective	0
Other	0		Air vents obstructed - intentionally	0
Heat exchanger			Air vents obstructed - unintentionally	0
Blockage - shale	0		Compartment/cupboard not to any standards	0
Blockage - soot	1		No permanent ventilation provided	0
Cracked	0		Ventilation provided was not to any standard	0
Other	0		**Miscellaneous**	
Safety device			Local topography	0
Failed CO alarm	0		Weather	0
Failed down draught detector	0		Signs of spillage – outside the appliance	1
Failed vitiation device	0		Signs of spillage – inside the casing	0

Table B.1.4b - Central heating boilers : thermal storage unit : Incident summary

Post Code	*Number of casualties: fatal (non-fatal)*	*Appliance age (yrs)*	*Appliance location*	*Installer*	*Flue to standards*	*Ventilation to standards*	*Appliance make & model*	*Flue type*	*Incident cause(s)*
NR1	(1)		9	Unknown	Current		Range Powermax FOV 155	22	1

B.1.5 WALL MOUNTED BOILER

Table B.1.5a - Central heating boilers : wall mounted boiler : Summary fault analysis

number of incidents=27

Fault group	*Number of faults*		*Fault group*	*Number of faults*
Burner			**Incident testing**	
Corrosion	1		High CO/CO_2 ratio	20
Defective flame picture	11		Failed spillage test	13
Linting	14		Overrated	3
Over-pressure	3		Underrated	3
Under-pressure	3		**Terminal**	
Other	4		Down draught	4
Flue			Bad siting	15
Blockage	0		Unapproved design	1
Corrosion	0		Other	2
Flue not to any standard	21		**Ventilation**	
Installation fault	19		Air vent/vents ineffective	9
Other	1		Air vents obstructed - intentionally	2
Heat exchanger			Air vents obstructed - unintentionally	2
Blockage - shale	10		Compartment/cupboard not to any standards	4
Blockage - soot	8		No permanent ventilation provided	8
Cracked	0		Ventilation provided was not to any standard	13
Other	5		**Miscellaneous**	
Safety device			Local topography	3
Failed CO alarm	0		Weather	20
Failed down draught detector	0		Signs of spillage – outside the appliance	13
Failed vitiation device	0		Signs of spillage – inside the casing	17

Table B.1.5bi - Central heating boilers : wall mounted boiler : Incident summary

Post Code	*Number of casualties: fatal (non-fatal)*	*Appliance age (yrs)*	*Appliance location*	*Installer*	*Flue to standards*	*Ventilation to standards*	*Appliance make & model*	*Flue type*	*Incident cause(s)*
NR31	(2)		9	Unknown			Glow-Worm Fuelsaver MK2 EP 40C	5	5
DT4	(2)		11	Unknown			Thorn Apollo 15/30C	8	5
BR2	(2)		10	Unknown			Potterton Flamingo 2 CF20/30	5	4,5,8
BH9	(8)	1	10	CORGI			Glow-Worm Economy Plus EP50C	5	4,5,8
SS7	(4)		9	Unknown			Glow-Worm Fuelsaver MK2 50	5	4,6,8,0
B70	(3)		10	Unknown			Potterton Flamingo 50 B/F	1	4,5
B32	(3)	20	10	Unknown		Current	Glow-Worm Fuelsaver 30/40	5	4
ST8	(4)		10	Unknown			Glow-Worm Fuelsaver 50B	1	1,5
DE55	(4)		10	Unknown			Glow-Worm Spacesaver 38	5	4,5,8
LN5	(2)		9	Unknown			Glow-Worm Fuelsaver MK2 50R	5	4,5,6,8
CA25	3		10	Unknown			Glow-Worm Fuelsaver MK2 50R	5	5
WN3	(2)		10	CORGI			Glow-Worm 45/60	5	5
M46	(2)		10	Unknown		Current	Glow-Worm Spacesaver 38	5	5
NP4	(2)	10	10	non-CORGI			Thorn Apollo 30/50C	5	4

Note: The incident cause code 0 was described as “Vitiation” at SS7.

Table B.1.5bii - Central heating boilers : wall mounted boiler : Incident summary

Post Code	*Number of casualties: fatal (non-fatal)*	*Appliance age (yrs)*	*Appliance location*	*Installer*	*Flue to standards*	*Ventilation to standards*	*Appliance make & model*	*Flue type*	*Incident cause(s)*
CV35	(3)		10	Unknown			Potterton Netaheat MK2 10/16	22	1
G71	(4)		9	Unknown			Ideal Elan OF 40	5	7
IG10	(4)		6	Unknown	Current		Glow-Worm Spacesaver 45/60	5	5
LU3	(1)		7	Unknown			Potterton Flamingo	5	4
NN4	(4)		10	Unknown		Current when installed	Glow-Worm Fuelsaver MK2 50	5	4
WF2	(1)			Unknown			Glow-Worm Spacesaver MK2	5	2,5,8
SR4	(5)		10	CORGI	Current when installed		Potterton Prima 40C	5	4
LL19	(3)	5	10	CORGI	Current when installed		Glow-Worm Economy Plus 75C	5	9
S72	(2)		11	Unknown			Glow-Worm Fuelsaver MK2	5	4
WR12	(3)		10	Unknown			Glow-Worm Fuelsaver MK2 600F	5	5
DL14	(1)	10		Unknown			Myson Apollo 30C	5	1
TS1	(2)	8	10	Unknown			Myson Apollo 30C	5	5,8
FY1	1		10	Unknown	Current		Myson Economist WM 40/55B	1	1,3,5

B.1.6 WALL MOUNTED COMBI BOILER

Table B.1.6a - Central heating boilers : wall mounted combi boiler : Summary fault analysis

number of incidents=19

Fault group	*Number of faults*		*Fault group*	*Number of faults*
Burner			**Incident testing**	
Corrosion	0		High CO/CO_2 ratio	15
Defective flame picture	4		Failed spillage test	6
Linting	9		Overrated	4
Over-pressure	6		Underrated	0
Under-pressure	0		**Terminal**	
Other	3		Down draught	3
Flue			Bad siting	8
Blockage	0		Unapproved design	0
Corrosion	0		Other	0
Flue not to any standard	12		**Ventilation**	
Installation fault	9		Air vent/vents ineffective	6
Other	1		Air vents obstructed - intentionally	4
Heat exchanger			Air vents obstructed - unintentionally	2
Blockage - shale	1		Compartment/cupboard not to any standards	3
Blockage - soot	3		No permanent ventilation provided	3
Cracked	0		Ventilation provided was not to any standard	10
Other	4		**Miscellaneous**	
Safety device			Local topography	2
Failed CO alarm	0		Weather	11
Failed down draught detector	0		Signs of spillage – outside the appliance	7
Failed vitiation device	0		Signs of spillage – inside the casing	12

Table B.1.6b - Central heating boilers : wall mounted combi boiler : Incident summary

Post Code	*Number of casualties: fatal (non-fatal)*	*Appliance age (yrs)*	*Appliance location*	*Installer*	*Flue to standards*	*Ventilation to standards*	*Appliance make & model*	*Flue type*	*Incident cause(s)*
UB1	1		10	Unknown	Current when installed		Vokera 18/72	8	0
BA2	(1)		10	Unknown			Vaillant VCW 20/1	8	5
N1	(4)		10	Unknown			Vaillant VCW 20/1 T3WH	5	4,7,8
B10	(7)		11	Unknown			Vaillant VCW GB 240H	5	4,6,8
LL57	(2)		10	Unknown	Current		Vaillant VCW GB 242EH	21	9
ST4	(1)	9	7	Unknown	Current		Ferroli 76CF	5	5
SN2	(2)		7	CORGI			Worcester 240	5	4
WV6	(5)	10	10	Unknown		Current	Vaillant VCW 20/1 T3WH	5	4
BB4	(1)			Unknown			Glow-Worm Hot Water Express	22	3,5
E17	(4)		10	Unknown		Current when installed	Vaillant VCW GB 240	5	5
G73	(2)		0	CORGI			Vaillant VCW 20/1 T3WH	5	5
PA20	(3)	11	12	CORGI			Vokera 21/84 MDCF	5	5
NW2	2		10	Unknown			Vaillant VCW GB 240H	5	4
NN2	(1)		10	Unknown			Vaillant VCW 20/1	5	4
WB6	(3)		9	Unknown			Vaillant VCW 20/1 T3WH	5	8
HA4	(3)	3	10	Unknown	Current		Saunier Duval Thelia 23	21	9
CV3	(3)	4	9	Unknown			Ferolli 77CF	5	4,5,8
HX2	(2)	15	3	Unknown	Current		Vaillant Sine 18 T3WFH	1	4
B98	(4)		10	Unknown	Current when installed	Current	Vaillant VCW GB 240H	5	1

Note: The incident cause code 0 was described as “Interference” at UB1.

B.1.7 WARM AIR UNIT

Table B.1.7a - Central heating boilers : warm air unit : Summary fault analysis

number of incidents=5

Fault group	*Number of faults*		*Fault group*	*Number of faults*
Burner			**Incident testing**	
Corrosion	0		High CO/CO_2 ratio	2
Defective flame picture	3		Failed spillage test	4
Linting	2		Overrated	0
Over-pressure	0		Underrated	0
Under-pressure	0		**Terminal**	
Other	0		Down draught	0
Flue			Bad siting	1
Blockage	0		Unapproved design	1
Corrosion	0		Other	0
Flue not to any standard	1		**Ventilation**	
Installation fault	1		Air vent/vents ineffective	1
Other	1		Air vents obstructed - intentionally	0
Heat exchanger			Air vents obstructed - unintentionally	1
Blockage - shale	0		Compartment/cupboard not to any standards	4
Blockage - soot	3		No permanent ventilation provided	1
Cracked	1		Ventilation provided was not to any standard	4
Other	0		**Miscellaneous**	
Safety device			Local topography	0
Failed CO alarm	0		Weather	1
Failed down draught detector	2		Signs of spillage – outside the appliance	2
Failed vitiation device	0		Signs of spillage – inside the casing	2

Table B.1.7b - Central heating boilers : warm air unit : Incident summary

Post Code	*Number of casualties: fatal (non-fatal)*	*Appliance age (yrs)*	*Appliance location*	*Installer*	*Flue to standards*	*Ventilation to standards*	*Appliance make & model*	*Flue type*	*Incident cause(s)*
B73	2	1	9	CORGI	Current		Johnson & Starley J50 MAF Highspec	5	2,8
NG11	(3)		10	Unknown	Current		McClary Economaire D40/60WH	5	1,8
NN3	(6)		9	Unknown	Current when installed		Johnson & Starley JT 19/25/JANUS	8	2,5,6,7
BH16	(3)	21	10	Unknown	Current when installed		Johnson & Starley J 15/22 MK3 MAF	5	7
LU4	(3)		9	Unknown			Johnson & Starley JT 19/25 MK2 MAF	5	2,5,6,8

Table B.1.8a – Central heating boilers : other : Summary fault analysis

number of incidents=1

Fault group	*Number of faults*		*Fault group*	*Number of faults*
Burner			**Incident testing**	
Corrosion	0		High CO/CO_2 ratio	1
Defective flame picture	0		Failed spillage test	0
Linting	0		Overrated	0
Over-pressure	1		Underrated	1
Under-pressure	0		**Terminal**	
Other	0		Down draught	0
Flue			Bad siting	0
Blockage	0		Unapproved design	0
Corrosion	0		Other	0
Flue not to any standard	1		**Ventilation**	
Installation fault	1		Air vent/vents ineffective	1
Other	0		Air vents obstructed - intentionally	0
Heat exchanger			Air vents obstructed - unintentionally	1
Blockage - shale	0		Compartment/cupboard not to any standards	0
Blockage - soot	0		No permanent ventilation provided	0
Cracked	0		Ventilation provided was not to any standard	1
Other	1		**Miscellaneous**	
Safety device			Local topography	1
Failed CO alarm	0		Weather	1
Failed down draught detector	0		Signs of spillage – outside the appliance	0
Failed vitiation device	0		Signs of spillage – inside the casing	0

Table B.1.8b - Central heating boilers : other : Incident summary

Post Code	*Number of casualties: fatal (non-fatal)*	*Appliance age (yrs)*	*Appliance location*	*Installer*	*Flue to standards*	*Ventilation to standards*	*Appliance make & model*	*Flue type*	*Incident cause(s)*
TR14	(6)	12	10	Unknown			Rayburn Novelle	5	4,8,0

Note: The incident cause code 0 was described as “Weather” at TR14. The appliance was described as a combined cooker/central heating unit.

B.2 COOKERS

B.2.1 FREE STANDING

Table B.2.1a - Cookers : free standing : Summary fault analysis

number of incidents=3

Fault group	*Number of faults*		*Fault group*	*Number of faults*
Burner			**Incident testing**	
Corrosion	2		High CO/CO_2 ratio	0
Defective flame picture	3		Failed spillage test	0
Linting	1		Overrated	0
Over-pressure	0		Underrated	0
Under-pressure	0		**Terminal**	
Other	2		Down draught	0
Flue			Bad siting	0
Blockage	0		Unapproved design	0
Corrosion	0		Other	0
Flue not to any standard	0		**Ventilation**	
Installation fault	0		Air vent/vents ineffective	0
Other	0		Air vents obstructed - intentionally	0
Heat exchanger			Air vents obstructed - unintentionally	0
Blockage - shale	0		Compartment/cupboard not to any standards	0
Blockage - soot	0		No permanent ventilation provided	0
Cracked	0		Ventilation provided was not to any standard	0
Other	0		**Miscellaneous**	
Safety device			Local topography	0
Failed CO alarm	0		Weather	0
Failed down draught detector	0		Signs of spillage – outside the appliance	0
Failed vitiation device	0		Signs of spillage – inside the casing	0

Table B.2.1b - Cookers : free standing : Incident summary

Post Code	*Number of casualties: fatal (non-fatal)*	*Appliance age (yrs)*	*Appliance location*	*Installer*	*Flue to standards*	*Ventilation to standards*	*Appliance make & model*	*Flue type*	*Incident cause(s)*
NE4	(1)		10	Unknown			Flavel Leisure 230	11	5
PO19	(1)		10	Unknown			Flavel Leisure Sable	11	2,5
SO19	(5)		10	Unknown			Flavel Leisure 2100	11	1,3,5

B.2.2 BUILT-IN OVEN – NO REPORTED INCIDENT

B.2.3 BUILT-IN HOB – NO REPORTED INCIDENT

B.2.4 OTHER

Table B.2.4a - Cookers : other : Summary fault analysis

number of incidents=1

Fault group	*Number of faults*		*Fault group*	*Number of faults*
Burner			**Incident testing**	
Corrosion	1		High CO/CO_2 ratio	0
Defective flame picture	1		Failed spillage test	0
Linting	0		Overrated	0
Over-pressure	0		Underrated	0
Under-pressure	0		**Terminal**	
Other	0		Down draught	0
Flue			Bad siting	0
Blockage	0		Unapproved design	0
Corrosion	0		Other	0
Flue not to any standard	0		**Ventilation**	
Installation fault	0		Air vent/vents ineffective	0
Other	0		Air vents obstructed - intentionally	0
Heat exchanger			Air vents obstructed - unintentionally	0
Blockage - shale	0		Compartment/cupboard not to any standards	0
Blockage - soot	0		No permanent ventilation provided	0
Cracked	0		Ventilation provided was not to any standard	0
Other	0		**Miscellaneous**	
Safety device			Local topography	0
Failed CO alarm	0		Weather	0
Failed down draught detector	0		Signs of spillage – outside the appliance	0
Failed vitiation device	0		Signs of spillage – inside the casing	0

Table B.2.4b - Cookers : other : Incident summary

Post Code	*Number of casualties: fatal (non-fatal)*	*Appliance age (yrs)*	*Appliance location*	*Installer*	*Flue to standards*	*Ventilation to standards*	*Appliance make & model*	*Flue type*	*Incident cause(s)*
EX34	(2)	25	10	Unknown			Leisure 76 MK 3	11	1,5

This appliance was described as a cooker grill and hob.

B.3 SPACE HEATERS

B.3.1 BALANCED FLUE GAS FIRE – NO REPORTED INCIDENT

B.3.2 CABINET HEATER – NO REPORTED INCIDENT

B.3.3 DECORATIVE GAS FIRE – NO REPORTED INCIDENT

B.3.4 FLUELESS HEATER – NO REPORTED INCIDENT

B.3.5 INSET LIVE FUEL EFFECT GAS FIRE

Table B.3.5a – Space heaters : inset live fuel effect gas fire : Summary fault analysis

number of incidents=1

Fault group	*Number of faults*		*Fault group*	*Number of faults*
Burner			**Incident testing**	
Corrosion	0		High CO/CO_2 ratio	1
Defective flame picture	1		Failed spillage test	0
Linting	1		Overrated	0
Over-pressure	0		Underrated	0
Under-pressure	0		**Terminal**	
Other	0		Down draught	0
Flue			Bad siting	0
Blockage	0		Unapproved design	0
Corrosion	0		Other	0
Flue not to any standard	0		**Ventilation**	
Installation fault	1		Air vent/vents ineffective	0
Other	0		Air vents obstructed - intentionally	0
Heat exchanger			Air vents obstructed - unintentionally	0
Blockage - shale	0		Compartment/cupboard not to any standards	0
Blockage - soot	0		No permanent ventilation provided	0
Cracked	1		Ventilation provided was not to any standard	0
Other	0		**Miscellaneous**	
Safety device			Local topography	0
Failed CO alarm	0		Weather	0
Failed down draught detector	0		Signs of spillage – outside the appliance	1
Failed vitiation device	0		Signs of spillage – inside the casing	1

Table B.3.5b - Space heaters : inset live fuel effect gas fire : Incident summary

Post Code	*Number of casualties: fatal (non-fatal)*	*Appliance age (yrs)*	*Appliance location*	*Installer*	*Flue to standards*	*Ventilation to standards*	*Appliance make & model*	*Flue type*	*Incident cause(s)*
HU8	(1)	14	12	Unknown	Current		Glow-Worm Flickerflame	5	5

B.3.6 RADIANT AND RADIANT CONVECTOR GAS FIRE

Table B.3.6a - Space heaters : radiant and radiant convector gas fire : Summary fault analysis

number of incidents=9

Fault group	*Number of faults*		*Fault group*	*Number of faults*
Burner			**Incident testing**	
Corrosion	0		High CO/CO_2 ratio	2
Defective flame picture	2		Failed spillage test	3
Linting	4		Overrated	0
Over-pressure	1		Underrated	1
Under-pressure	0		**Terminal**	
Other	1		Down draught	0
Flue			Bad siting	0
Blockage	3		Unapproved design	0
Corrosion	1		Other	1
Flue not to any standard	2		**Ventilation**	
Installation fault	1		Air vent/vents ineffective	1
Other	0		Air vents obstructed - intentionally	1
Heat exchanger			Air vents obstructed - unintentionally	0
Blockage - shale	0		Compartment/cupboard not to any standards	0
Blockage - soot	1		No permanent ventilation provided	0
Cracked	1		Ventilation provided was not to any standard	1
Other	1		**Miscellaneous**	
Safety device			Local topography	0
Failed CO alarm	0		Weather	1
Failed down draught detector	1		Signs of spillage – outside the appliance	5
Failed vitiation device	0		Signs of spillage – inside the casing	3

Table B.3.6b - Space heaters : radiant and radiant convector gas fire : Incident summary

Post Code	*Number of casualties: fatal (non-fatal)*	*Appliance age (yrs)*	*Appliance location*	*Installer*	*Flue to standards*	*Ventilation to standards*	*Appliance make & model*	*Flue type*	*Incident cause(s)*
LE67	(3)		6	Unknown	Current		Radiation HSG Super 4	5	4
N17	(1)		10	Unknown	Current		Glow-Worm Miami	5	1
DN14	(1)		12	Unknown			Economic Seafire M	5	3
FY1	1		3	Unknown			Valor Quattro	5	4
CF32	1	16	12	Unknown	Current		Baxi Bermuda W3	5	5
CF40	1	16	12	CORGI	Current		Cannon Misermatic	5	4
CH6	(2)		12	Unknown			Main Fireflame Deluxe	5	4
KY2	(1)		12	Unknown	Current when installed		Parkinson Cowan Prima TC	5	4,5
LS9	(1)	6	12	CORGI	Current		Valor Firelite	5	5

B.3.7 WALL HEATER – NO REPORTED INCIDENT

B.3.8 OTHER – NO REPORTED INCIDENT

B.4 TUMBLE DRYERS

B.4.1 TUMBLE DRYERS – NO REPORTED INCIDENT

B.5 WATER HEATERS

B.5.1 BULK STORAGE – NO REPORTED INCIDENT

B.5.2 CIRCULATOR – NO REPORTED INCIDENT

B.5.3 MULTI-POINT – NO REPORTED INCIDENT

B.5.4 SINGLE-POINT

Table B.5.4a - Water heaters : single-point : Summary fault analysis

number of incidents=1

Fault group	*Number of faults*		*Fault group*	*Number of faults*
Burner			**Incident testing**	
Corrosion	0		High CO/CO_2 ratio	1
Defective flame picture	1		Failed spillage test	0
Linting	1		Overrated	0
Over-pressure	0		Underrated	0
Under-pressure	0		**Terminal**	
Other	0		Down draught	0
Flue			Bad siting	0
Blockage	0		Unapproved design	0
Corrosion	0		Other	0
Flue not to any standard	0		**Ventilation**	
Installation fault	0		Air vent/vents ineffective	0
Other	0		Air vents obstructed - intentionally	0
Heat exchanger			Air vents obstructed - unintentionally	0
Blockage - shale	0		Compartment/cupboard not to any standards	0
Blockage - soot	0		No permanent ventilation provided	0
Cracked	1		Ventilation provided was not to any standard	1
Other	1		**Miscellaneous**	
Safety device			Local topography	0
Failed CO alarm	0		Weather	0
Failed down draught detector	0		Signs of spillage – outside the appliance	0
Failed vitiation device	0		Signs of spillage – inside the casing	0

Table B.5.4b - Water heaters : single-point : Incident summary

Post Code	*Number of casualties: fatal (non-fatal)*	*Appliance age (yrs)*	*Appliance location*	*Installer*	*Flue to standards*	*Ventilation to standards*	*Appliance make & model*	*Flue type*	*Incident cause(s)*
SW12	(4)		10	Unknown			Chaffoteaux Corvec Celt 2FPH	11	1,5

B.5.5 OTHER – NO REPORTED INCIDENT

APPENDIX C DETAILS OF LPG INCIDENTS DURING 2000/2001 AND ANALYSIS OF THE DATA

Five LPG incidents were reported using the DIDR Form 551/7 during the period 2000/2001. Incident A occurred in March 2001 in a ground floor, bedsit flat which was under tenanted, multiple occupancy. It was built in 1900 and was privately owned. Incident B took place during November 2000 in an owner occupied, mobile caravan which was built in 1990. Incident C took place during October 2000. It also took place in an owner occupied, mobile caravan which was built between 1981 and 1991. Incident D took place during September 2000 within a narrow boat moored on a canal. The boat was built during 1988. Incident E took place during May 2000 in a detached house in Guernsey, which was built in 2000. It was a tenanted, single occupancy property which was privately owned. Although outside the normal area covered by this report, it has been included for general information.

Some details of these incidents and casualties are given in Table C1.

Table C1 - CO incidents and casualties

Incident	*Post code*	*Appliance involved*	*Numbers of fatal casualties*	*Numbers of non-fatal casualties*			
				N1	N2	N3	N4
A	RH19	Cabinet heater	1	0	0	0	0
B	N/A	Free standing cooker	1	0	0	0	0
C	N/A	Rad/rad convector fire	2	0	0	0	0
D	N/A	Refrigerator	1	1	0	0	0
E	N/A	Decorative fire	0	0	1	0	0

Note: Non-fatal casualty codes are explained in Section 2.2

In all cases, the casualties were in the same properties as the appliances involved. Details of the appliance and casualty locations are given in Table C2.

Table C2 - Appliance and casualty locations

Incident	*Appliance location*	*Casualty locations*	*Flue type*
A	Bedsit	Bedsit	11
B	Kitchen	Unknown	11
C	Living room/lounge	Living room/lounge	11
D	Kitchen	Unknown	5
E	Living room/lounge	Living room/lounge	5

Note: Flue type codes are detailed in Appendix B, Table B/A2

The incident appliance make and model, and installation details where known, are given in Table C3.

Table C3 – Appliance and standards details

Incident	*Appliance make & model*	*Appliance age (years)*	*Installer*	*Appliance installed to standards*	*Flue to standards*	*Ventilation to standards*
A	Alvima APP Mk4	Unknown	DIY	Yes	N/A	N/A
B	Unknown	Unknown	Unknown	Unknown	N/A	N/A
C	Rondo Renee Sunstore	Unknown	Unknown	Unsure	N/A	Unsure
D	Electrolux RM212F	Unknown	Unknown	No	No	Unsure
E	Jetmaster Blenheim 18 Inch Mk4	1	Unknown	No	Yes	No

The following faults and relevant observations were reported:

Incident A – There was 1 additional appliance which was producing CO into the property and 1 additional appliance with sub-standard faults. The mobile cabinet heater was supplied second hand by the landlord to the tenant and it did not have any safety certification. The plaque was cracked, which led to poor combustion taking place. A vitiation device was fitted to the heater and this was found to be operational. It was noted that the occupants had previously experienced symptoms associated with CO poisoning.

Incident B – The incident involved a cooker supplied by piped gas from a Calor cylinder. It was attended by the HSE who were unable to provide further details or any established incident cause.

Incident C – Ventilation was required and was provided, but had been intentionally obstructed. This was listed as one of the causes of the incident. Details of the appliance installation were unknown but the burner had a defective flame picture. A lack of servicing was given as the second cause of the incident.

Incident D – The refrigerator was a type that was not recommended for installation on a boat. Other information relating to the installation details were unknown. The flue was not to standard, with a non-standard terminal fitted and the ventilation provided had been intentionally obstructed. The appliance had been visited for a breakdown/service less than 6 months prior to the incident and it was also noted that the occupants had previously experienced symptoms associated with CO poisoning.

Incident E – The appliance had been installed new during the previous year. The installation was not to standard. It was noted that the fire was not sealed to the wall and the gas supply pipe had not been sealed. Ventilation was required, but had not been provided and the burner pressure was set low. At the time of the investigation high levels of CO were not being produced or entering the property. The incident cause was given as “possible flue inversion”.

Table C4 gives the total numbers of faults found, at the five installations involved, and table C5 gives the reported incident cause/causes.

Table C4 - Incident appliance faults

Fault group	*Number of faults*		*Fault group*	*Number of faults*
Burner			**Incident testing**	
Corrosion	0		High CO/CO_2 ratio	2
Defective flame picture	2		Failed spillage test	0
Linting	0		Overrated	0
Over-pressure	0		Underrated	0
Under-pressure	1		**Terminal**	
Other	0		Down draught	0
Flue			Bad siting	0
Blockage	0		Unapproved design	1
Corrosion	0		Other	0
Flue not to any standard	1		**Ventilation**	
Installation defect	0		Air vent/vents ineffective	2
Other	1		Air vents obstructed - intentionally	2
Heat exchanger			Air vents obstructed - unintentionally	0
Blockage – shale	0		Compartment/cupboard not to any standards	0
Blockage – soot	0		No permanent ventilation provided	1
Cracked	0		Ventilation provided was not to any standard	2
Other	0		**Miscellaneous**	
Safety device			Local topography	0
Failed CO alarm	0		Weather	0
Failed down draught detector	0		Signs of spillage – outside the appliance	0
Failed vitiation device	0		Signs of spillage – inside the casing	0

Note: the cause under "other" was described as white deposits in the flue tube of the refrigerator in incident D.

Table C5 – Incident causes

Incident cause (s)	*Total number recorded*
Appliance fault	2
Appliance installation fault	1
Customer misuse of the appliance	0
Flue/terminal fault	1
Lack of servicing	2
Sub-standard compartment	0
Sub-standard servicing	0
Ventilation fault	2
Not known/not yet established	1
Other	1

Note: the cause under "other" was described as flue inversion for incident E.

APPENDIX D DETAILS OF NON-DOMESTIC CO INCIDENTS DURING 2000/2001 AND ANALYSIS OF THE DATA

Two incidents involving piped natural gas within business properties were reported, using the DIDR form 551/7 during the year 2000/2001. Incident A occurred in an office and incident B in a commercial unit. Property A was built between 1946 and 1965, whilst B was built prior to 1945.

Incident A occurred in October 2000 and affected 10 male adults and 3 female adults who were located in the reception area and the corridor leading to reception. Incident B (during February 2001) was a fatal incident which involved a 30-year old female.

Some details of these incidents and the resulting casualties are given in Table D1 below.

Table D1 – CO incidents and casualties

Incident	*Post code*	*Appliance involved*	*Number of fatal casualties*	*Number of non-fatal casualties*			
				N1	*N2*	*N3*	*N4*
A	WS11	Floor standing boiler	0	0	7	6	0
B	B9	Floor standing boiler	1	0	0	0	0

Note: Non-fatal casualty codes are explained in Section 2.2

In each case, the incident appliance was located in the same property as the casualties. Details of the appliance and casualty locations are given in Table D2.

Table D2 - Appliance and casualty locations

Incident	*Appliance location*	*Casualty locations*	*Flue type*
A	Reception area and the corridor leading to reception	Reception area and the corridor leading to reception	5
B	Plant room	Bathroom	5

Note: Flue type codes are detailed in Appendix B, Table B/A2

Details of the incident appliance make and model are given in Table D3.

Table D3 – Appliance and Standards details

Incident	*Appliance make & model*	*Appliance age (years)*	*Installer*	*Appliance installed to standards*	*Flue to standards*	*Ventilation to standards*
A	Powrmatic/Sime RS10	Unknown	Unknown	No	No	No
B	Potterton Diplomat HE	Unknown	Unknown	No	No	No

The following faults and relevant observations were reported:

Incident A – There were 2 other appliances with "sub-standard" faults within the owner occupied office building. The incident appliance passed a flue flow and continuity check and was said to be susceptible to chilling. The ventilation was sub-standard, but the vents that were fitted were unobstructed at the time of the incident. The flue was also sub-standard and a flue installation fault was noted. The appliance failed a spillage test and signs of spillage were evident outside the appliance. The appliance had additionally an installation fault and had been subject to sub-standard servicing, by a non-CORGI registered fitter, between 6 to 12 months prior to the incident. The weather was also a contributory cause to the incident.

Incident B – The commercial unit was part of a multiple occupancy, tenanted property. The appliance installation, flue and ventilation were all below standard. The incident appliance passed a flue flow and continuity check and was said to be susceptible to chilling. The ventilators that were fitted were unobstructed at the time of the incident. The appliance failed a spillage test and signs of spillage were evident outside the appliance. The appliance was last visited by a CORGI registered fitter 13 months before the incident following a report of fumes when occupants experienced typical CO symptoms. The warning notices issued at the time were no longer attached to the appliance. The appliance had been subject to sub-standard servicing and faults indicated were linting and a shale blocked heat exchanger. The weather was also a contributory cause to the incident.

Table D4 gives the total numbers of faults found at the two installations involved and table D5 gives the reported incident cause/causes.

Table D4 – Incident appliance faults

Fault group	*Number of faults*		*Fault group*	*Number of faults*
Burner			**Incident testing**	
Corrosion	0		High CO/CO_2 ratio	2
Defective flame picture	0		Failed spillage test	2
Linting	2		Overrated	0
Over-pressure	0		Underrated	0
Under-pressure	0		**Terminal**	
Other	0		Down draught	0
Flue			Bad siting	0
Blockage	0		Unapproved design	0
Corrosion	0		Other	0
Flue not to any standard	2		**Ventilation**	
Installation defect	1		Air vent/vents ineffective	0
Other	0		Air vents obstructed - intentionally	0
Heat exchanger			Air vents obstructed - unintentionally	0
Blockage - shale	2		Compartment/cupboard not to any standards	0
Blockage - soot	0		No permanent ventilation provided	0
Cracked	0		Ventilation provided was not to any standard	2
Other	0		**Miscellaneous**	
Safety device			Local topography	0
Failed CO alarm	0		Weather	2
Failed down draught detector	0		Signs of spillage – outside the appliance	2
Failed vitiation device	0		Signs of spillage – inside the casing	0

Table D5 – Incident causes

Incident cause (s)	*Total number recorded*
Appliance fault	0
Appliance installation fault	1
Customer misuse of the appliance	0
Flue/terminal fault	2
Lack of servicing	0
Sub-standard compartment	0
Sub-standard servicing	2
Ventilation fault	2
Not known/not yet established	0
Other	0

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