



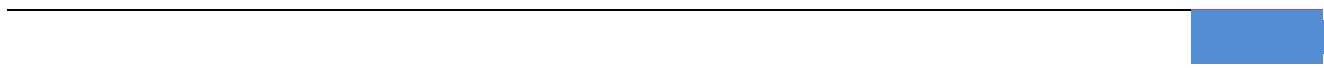
Government of **Western Australia**
Department of **Commerce**
EnergySafety

Gas incident safety report 2014-15

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Preface

This report by EnergySafety summarises information about gas incidents in Western Australia and analyses statistical trends for the years 2005/06 to 2014/15.

EnergySafety has statutory responsibility for the safety regulation of most gas facilities (downstream of transmission pipelines) and activities in Western Australia.

The report provides practical information on how well the State's industry and general community are operating in the supply and use of gas.

EnergySafety uses the information to make assessments on:

- the effectiveness of safety education and regulatory mechanisms (including mandatory technical requirements); and
- changes that should be considered to improve industry and community gas safety outcomes.

These assessments are the subject of continuing policy work by EnergySafety which includes extensive consultation with gas industry stakeholders.

I am confident that the information will interest those involved in the State's gas industry.

Ken Bowron
DIRECTOR OF ENERGY SAFETY

December 2015

Executive summary

This report is an analysis of gas incidents reported to EnergySafety over a ten year period from 1 July 2005 to 30 June 2015.

The distribution of gas across Western Australia is varied in terms of reticulated natural gas (NG), liquefied petroleum gas (LPG) and bottled LPG.

There were 807 gas related incidents reported in the ten years from 2005/06 to 2014/15. Of these, 74% were related to gas utilisation and 26% to gas supply. Overall gas supply incidents recorded by EnergySafety have shown a higher safety outcome as compared to gas utilisation.

Analysis of workplace and non-workplace incidents indicates that gas supply had more workplace incidents in comparison to gas utilisation where a higher number of incidents occurred in a non-workplace setting.

There were five fatal incidents which resulted in seven fatalities over the reporting period.

A fatality occurred in 2014/15 in a caravan fire where the person was trapped inside. The police found a gas cylinder inside the caravan that had a loose connection and was partially on. The cause of this fatal incident is still undetermined.

There were 9 incidents which resulted in serious injury in 2014/15 bringing the total number of incidents in this category to 77 since 2005/06.

During 2014/15, there were 13 incidents which resulted in minor injury. There were 109 such incidents during the reporting period.

Introduction

The Gas Standards (Gasfitting and Consumer Gas Installations) Regulations 1999 require that an incident involving the sudden discharge of gas or that otherwise relates to gas and causes or is likely to cause injury to a person or damage to property must immediately be reported to the Director of Energy Safety and to the relevant gas supplier where applicable. The Gas Standards (Gas Supply and System Safety) Regulations 2000 specify levels of major discharge of gas in incidents that need to be reported to the Director of Energy Safety.

All reported incidents are recorded on a database maintained by EnergySafety. The information contained within this report has been compiled from this data. This report provides a comparative analysis of trends in terms of frequency of incidents. EnergySafety is the regulator for downstream gas incidents in Western Australia.

The introduction of mandatory reporting of gas incidents in 1999 resulted in a significant increase in the amount of data recorded, indicating a greater awareness of the reporting requirements. This report focuses on the ten year period from 2005/06 to 2014/15.

Gas related incidents can vary from a gas leak to a fatality. This report analyses incidents resulting in fatality, serious injury and minor injury and has been categorised into two major sections based on utilisation and supply of gas. The majority of incidents reported relate to gas utilisation and this segregation allows for a better understanding of the data in identifying trends.

EnergySafety acknowledges the contribution of the Economic Regulation Authority for its permission to utilise and reprint the 'Gas Licensing Distribution Systems and Trading Locations' map as sourced from its website.

Abbreviations

FAFR – Fatal Accident Frequency Rate

LPG – Liquid Petroleum Gas

NG – Natural gas

PMP – per million population

WA – Western Australia

Definitions and explanatory notes

Gas related incident

For the purpose of this report a gas related incident refers to any incident that involves the sudden uncontrolled discharge of gas or that otherwise relates to gas and may or may not cause or be likely to cause injury to a person or damage to property.

FAFR

Fatal accident frequency rate is calculated with the formula:

$$\text{FAFR} = \frac{\text{Number of fatal accidents per year}}{\text{Number of people at risk to the exposure of gas (population)}}$$

For ease of communication, the FAFR is multiplied by a million. Therefore the figure arrived at is the FAFR x 10⁶. This figure allows a comparison of gas safety performance.

This is also referred to in the report as 'the fatalities per million population'.

Fatality

An incident in which gas was found to be the cause and that resulted in accidental death.

Serious injury

An incident in which gas was found to be the cause and that resulted in such an injury that hospitalisation was required.

Minor injury

An incident in which gas was found to be the cause and resulted in such an injury that may have required medical attention but did not require hospitalisation.

Other incidents

A gas related incident that has not resulted in injury or fatality.

Major discharge

A major discharge is the unplanned and uncontrolled release inside a building of 10 m³ or more of gas or the unplanned and uncontrolled release in the open air of 1,000 m³ or more of gas.

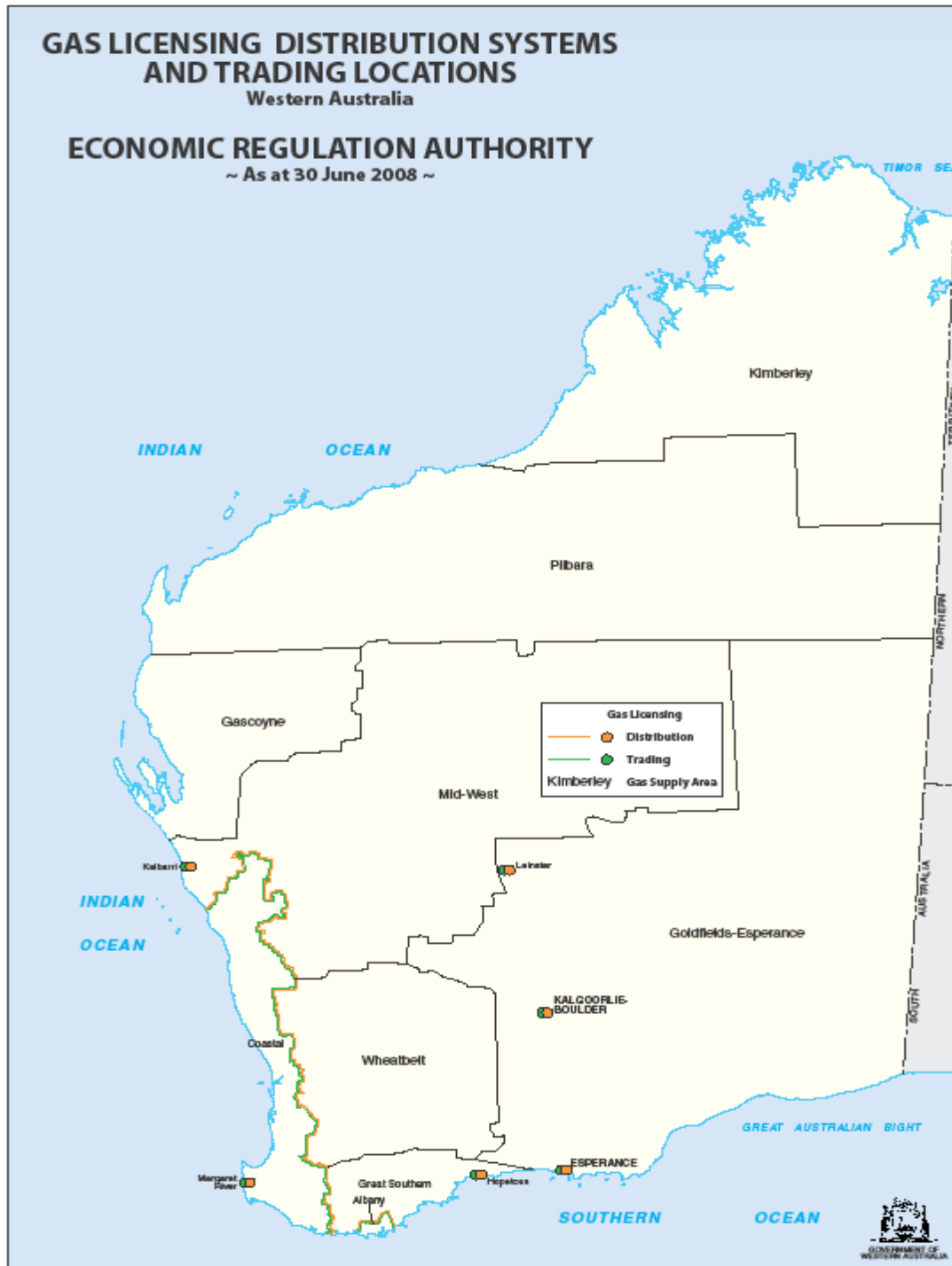
Limitations of this report:

- This report is based on information derived from rigid legacy systems due for replacement in the near future. Parts of the data have been manually noted and then summarised for analysis. While care has been taken in the process of documenting this report, the risk of human error is still present.
- Fatalities where gas was involved but was not found to be the cause of the incident have been excluded from this report.
- The number of incidents in this report may vary in comparison to other documents previously released by Energy Safety. Although legislation requires prompt notification of incidents, there can be extended delays between when an incident occurs and when notification is received and this can impact on the data. This is more evident in cases with low severity. In other instances, some incidents may be found to be non-gas related after investigation and hence not included in the report.
- To arrive at the FAFR, the demographic population has been utilised as the number of people at risk to the exposure of gas.

Distribution of gas in WA

Distribution of gas across the state is varied. The Perth Metropolitan Area, Kalgoorlie, Esperance, Bunbury and Geraldton are serviced by reticulated natural gas. Margaret River, Leinster, Albany and Hopetown have reticulated LPG, while bottled LPG is available and utilised throughout WA.

Figure 1: Map of Western Australia¹

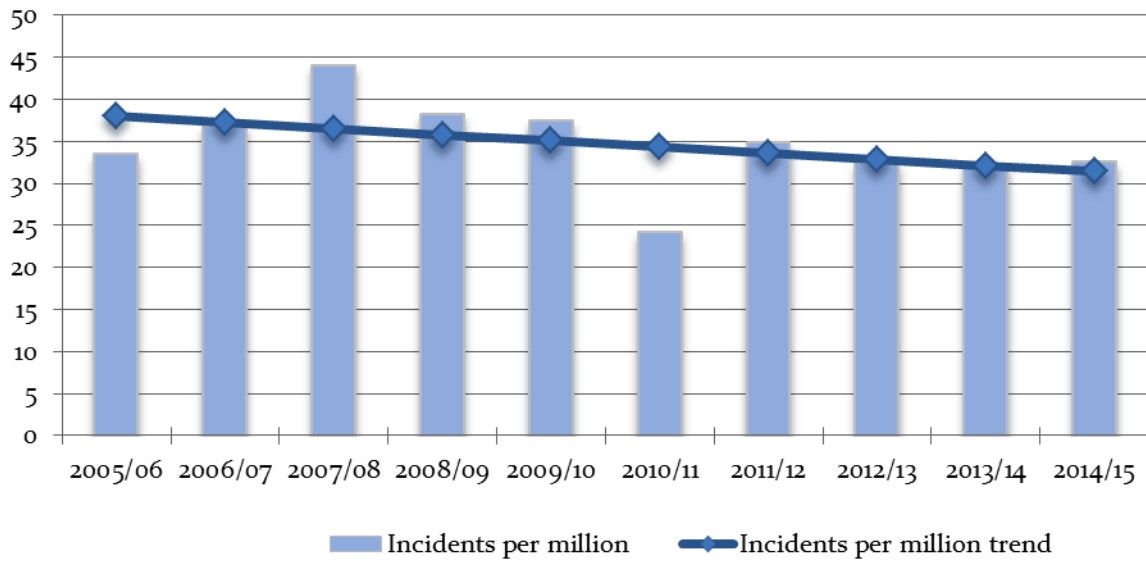


¹ Sourced and reprinted with permission from the Economic Regulation Authority.

Gas incidents recorded in WA

There were 807 gas related incidents reported from 2005/06 to 2014/15. The number of reported incidents per million population has been represented in Figure 2 below. During the ten year reporting period, the most number of incidents were reported in 2007/08 with the trend showing a steady decline in the number of incidents.

Figure 2: Number of WA gas related incidents per million population

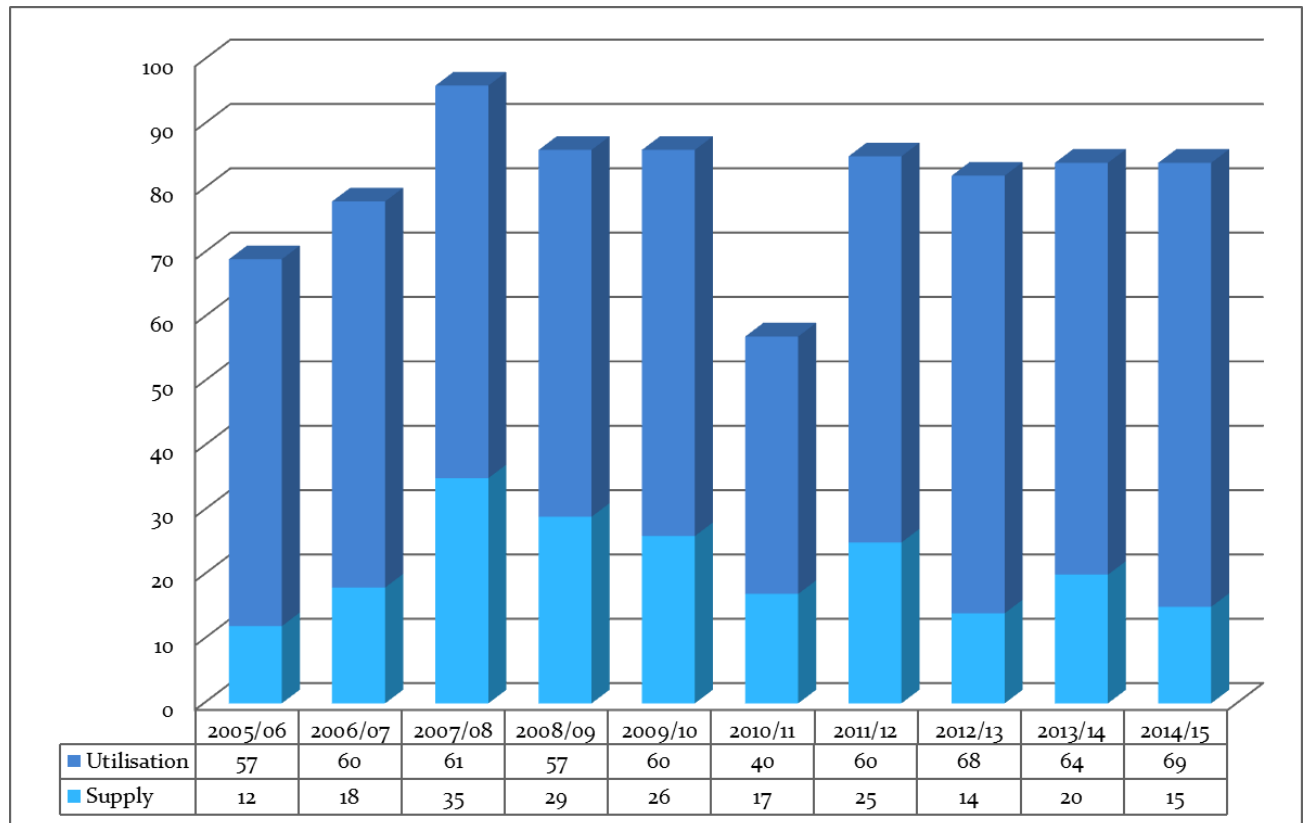


There were 32 incidents per million people, of these 12 incidents per million resulted in some form of injury.

All the incidents recorded can be broadly classified into gas utilisation and supply incidents. 74% of all incidents in the reported period were related to gas utilisation. The high number of reported gas utilisation incidents may be due to the legislative requirement to report gas incidents.

For supply incidents, there is a requirement to report incidents which have a major discharge of gas. Figure 3 below provides information on the number of incidents reported to EnergySafety each year.

Figure 3: Number of incidents by gas utilisation and supply



Fatalities

There have been five fatal incidents that resulted in seven fatalities.

A fatal incident which occurred in 2006/07 caused the death of a mother and her two children. It resulted from an escape of LPG from a two burner camping gas stove believed to have been left unattended for a brief time. Nearby combustibles caught fire which ultimately consumed the front portion of the house in Karrinyup. The three deceased were found in a bedroom unable to escape the fire.

A fatality which occurred in 2009/10 related to an explosion involving a gas cylinder where cylinder abuse was identified as the cause. The fatality was a result of medical complications relating to burns received from the explosion.

There was a fatality which occurred in 2012/13 due to LPG leaking from a mechanical bolted sleeved coupling on a gas main in the verge, near the residence at 282 Middleton Road, Centennial Park, Albany and permeated into the lower ground floor bedroom of the residence. The presence of LPG as a vapour cloud in the bedroom was ignited by an electrical source. The explosion and fire that followed proved fatal to a resident.

The fatality reported in 2013/14 involved a victim that was alleged to have been using LPG during the manufacture of an illegal substance. There was a fire and explosion in which the victim sustained burns and later succumbed to his injuries.

During 2014/15, a fatality occurred in a caravan fire where the person was trapped inside. The police found a gas cylinder inside the caravan that had a loose connection and was partially on. The cause of this fatal incident is still undetermined.

Figure 4: Fatalities and fatal incidents

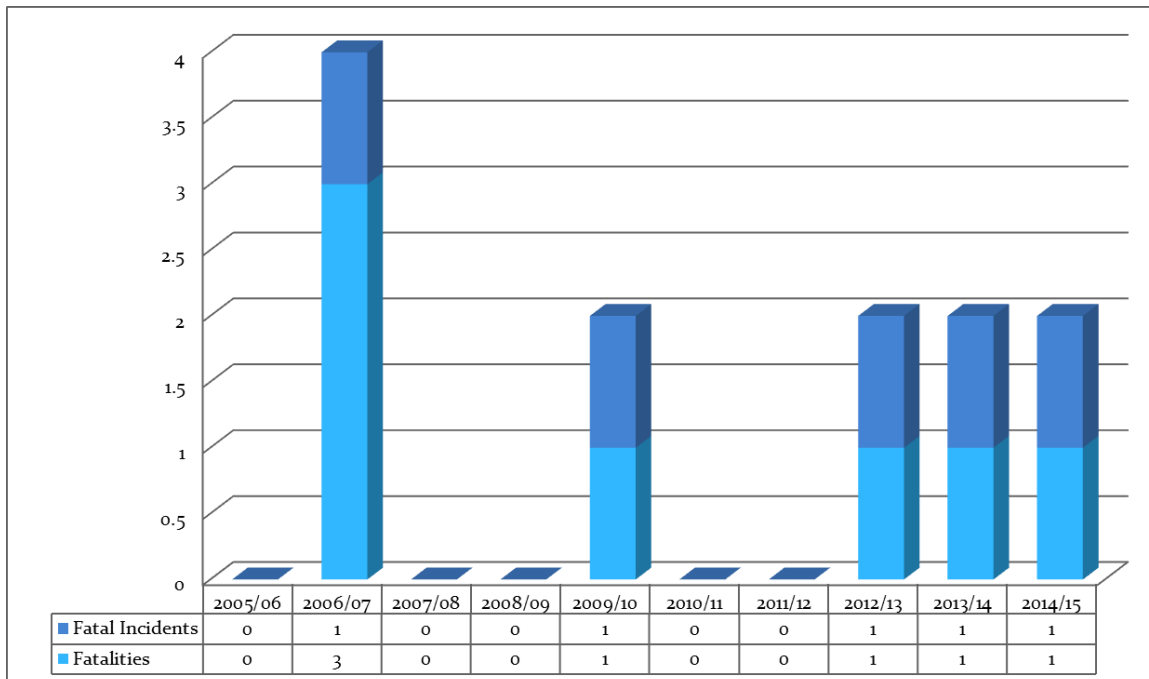


Figure 4 shows that fatalities arising from gas incidents may impact more than one person in a single incident as is evident from the incident which occurred in 2006/07 involving a camping stove causing three fatalities.

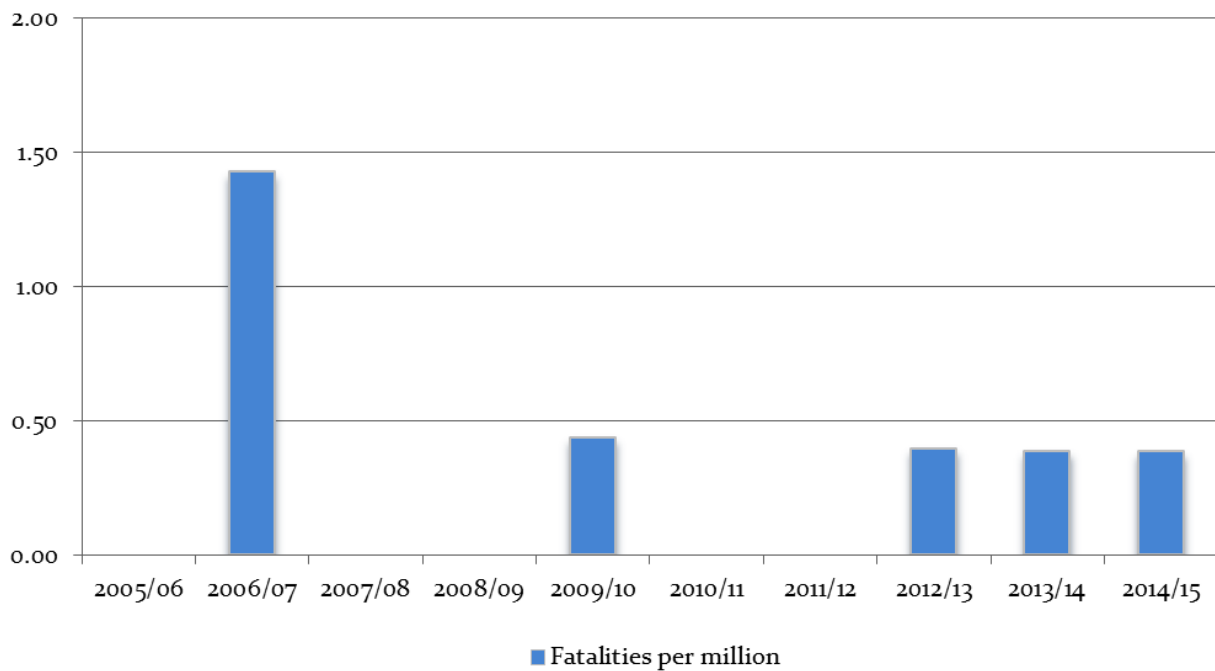
For ease of comparison, the 'Fatal Accident Frequency Rate' is utilised to compare gas safety performance in a changing demographic population. This is also referred to as the fatalities per million population.

Table 5 below lists the FAFR over the reporting period and Figure 5 provides a graphical view of the number of fatalities per million population.

Table 5: Fatal Accident Frequency Rate

Year	FAFR x 10 ⁶
2005/06	0.00
2006/07	1.42
2007/08	0.00
2008/09	0.00
2009/10	0.44
2010/11	0.00
2011/12	0.00
2012/13	0.40
2013/14	0.39
2014/15	0.38

Figure 5: Fatalities per million population

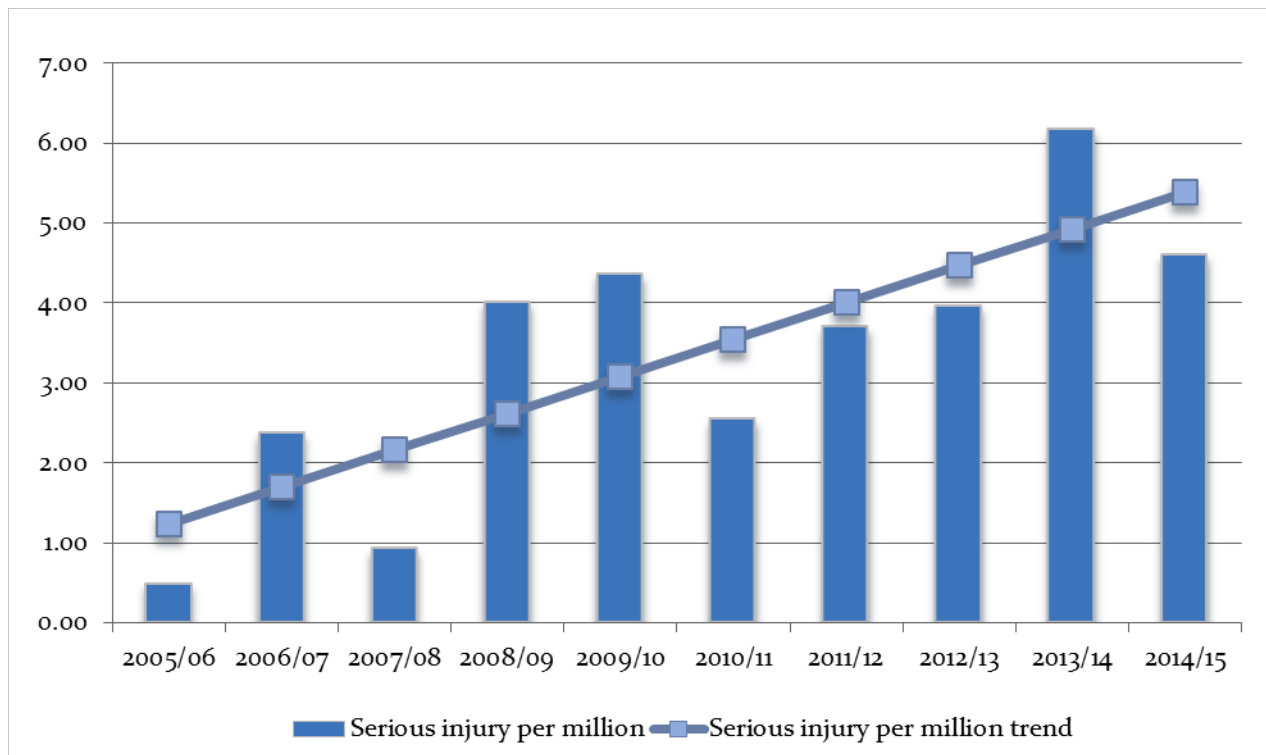


Since the establishment of EnergySafety in 1994 there has been no gas related fatalities involving a gas worker which suggests that the safety of gas workers is generally maintained at a high level.

Serious injury

Non-fatal gas incidents have been classified into two groups, those causing serious injury requiring hospitalisation and those causing minor injury. Figure 6 below shows the number of incidents resulting in serious injury per million population. Trends indicate an increase in incidents reported in this area.

Figure 6: Serious injury per million population



The majority of incidents resulting in serious injury involved cookers, recreational equipment (predominately barbeques) and water heaters.

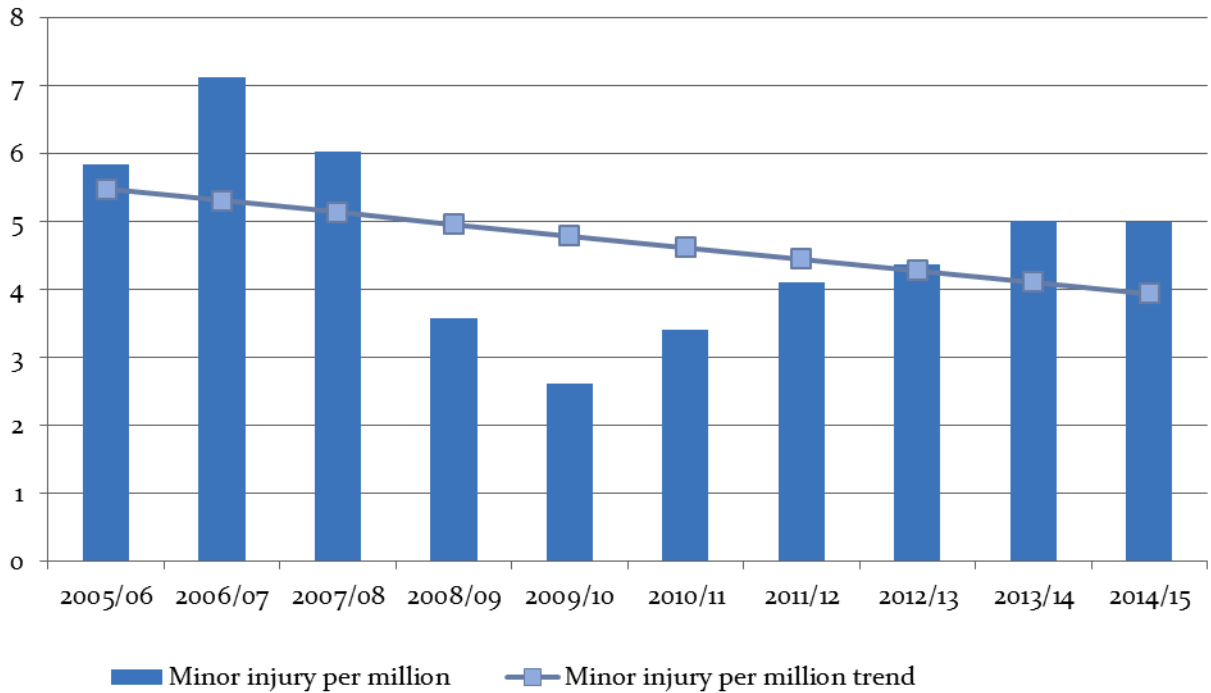
Unsafe installation was identified as a major cause of incidents involving cookers and component failure/design fault in recreational equipment. Incidents involving water heaters resulted mainly from improper use of the unit.

One incident in 2014/15 caused serious injury to four people. The incident involved a lunchbox gas cooker with a butane canister which exploded during use. A safety issue with such cookers has been highlighted by EnergySafety. More information is available on the Division's website discouraging the use of cookers which have been prohibited from sale and use.

Minor injury

Minor injuries resulting from gas incidents show a decreasing trend over the reporting period with a slight increase in the number of incidents in the last two years as indicated in Figure 7.

Figure 7: Minor injury per million population



A significant number of incidents resulting in minor injury were caused by operational defects related to component failure and improper use or unskilled interference with gas equipment.

Gas utilisation

Gas utilisation incidents

There were 596 gas utilisation incidents reported during the period 2005/06 to 2014/15. 28% occurred within a workplace setting and the remainder within the larger community. Figure 8 below shows the distribution between workplace and non-workplace incidents over the past ten years.

Figure 8: Gas utilisation incidents – Workplace and non-workplace

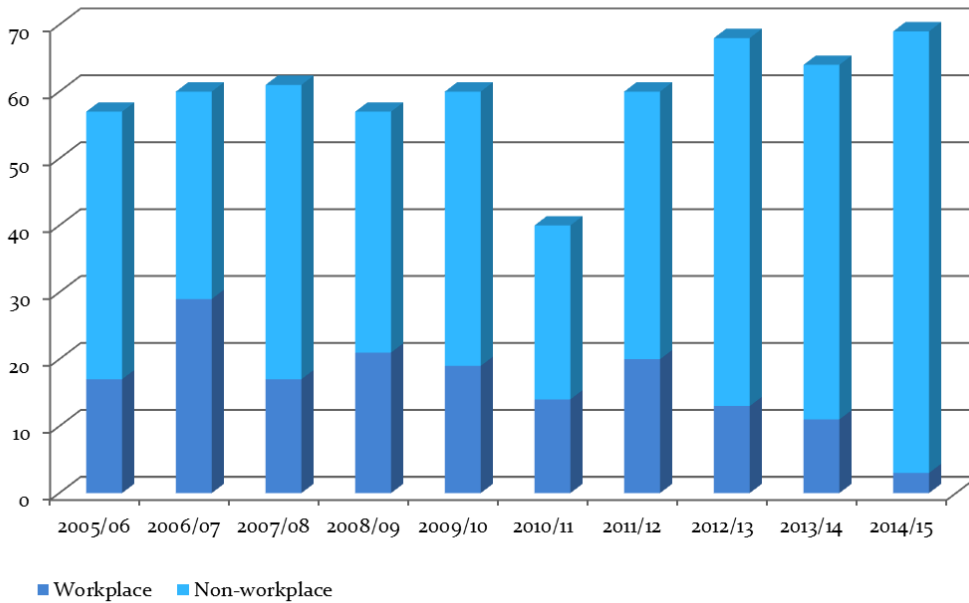


Figure 8A shows the percentage distribution of workplace and non-workplace incidents.

Figure 8A: Gas utilisation incidents – Workplace and non-workplace

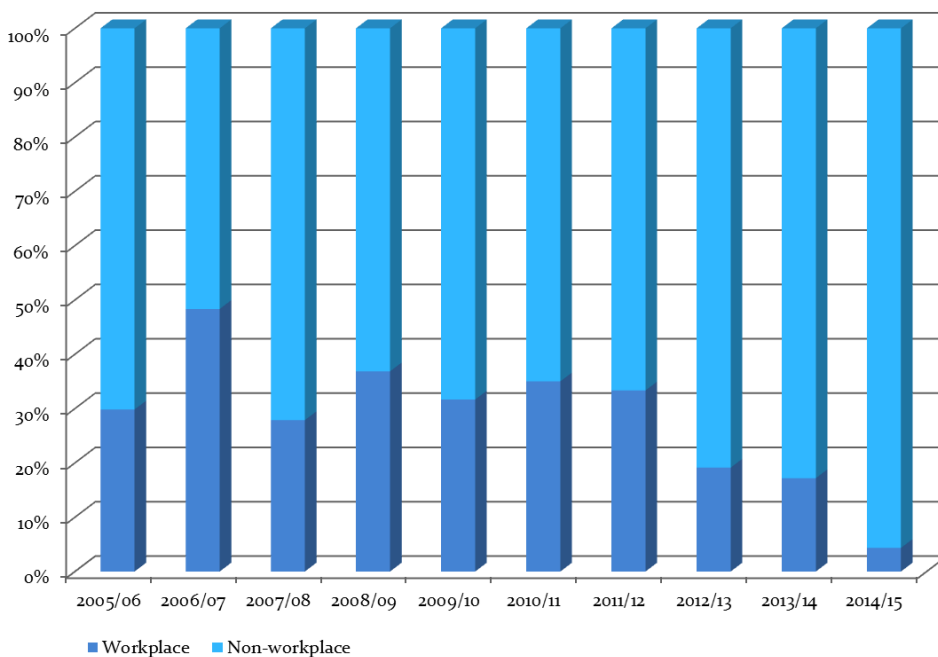
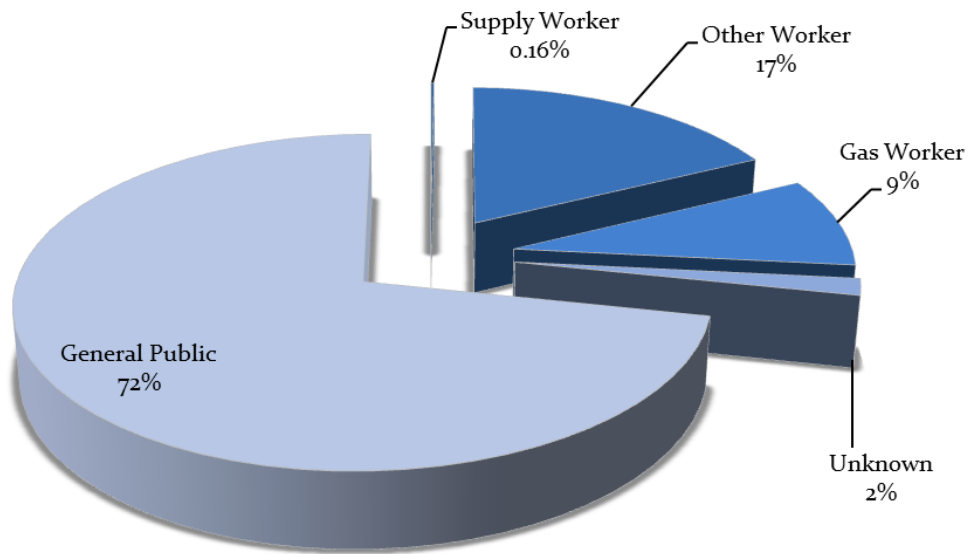


Figure 9 below is a classification of incidents according to broad categories of workers and the general public. Gas workers were involved in 9% of the incidents.

Figure 9: Gas utilisation incidents – Workers versus general public

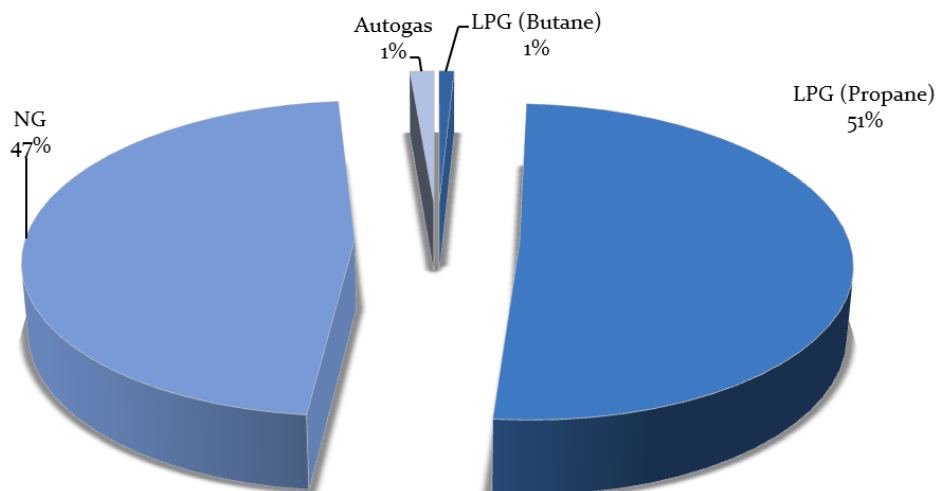


Gas utilisation incidents – by type of gas

Natural gas, LPG (Propane), LPG (Butane) and auto gas are the main types of gas utilised in Western Australia.

Figure 10 below provides a graphical view of incidents in relation to the type of gas. 47% of incidents involved NG, followed by LPG (Propane) at 51%.

Figure 10: Gas utilisation incidents – Type of gas



The percentage of incidents involving butane and auto gas is low compared to NG and LPG (propane). There have been 5 incidents involving butane and 8 incidents related to auto gas over the ten year period.

There was one notable incident involving butane in 2004/05, where a lunchbox gas cooker with a butane canister exploded causing serious injury to four people.

Figure 11 and figure 12 are a classification of the type of incidents reported to EnergySafety segregated by the type of gas. This breakdown of incident types has not altered by a significant margin over the ten year reporting period. Charts have not been prepared for butane and autogas due to the low number of incidents in those categories.

Figure 11: Gas utilisation incidents – Type of incidents resulting from NG

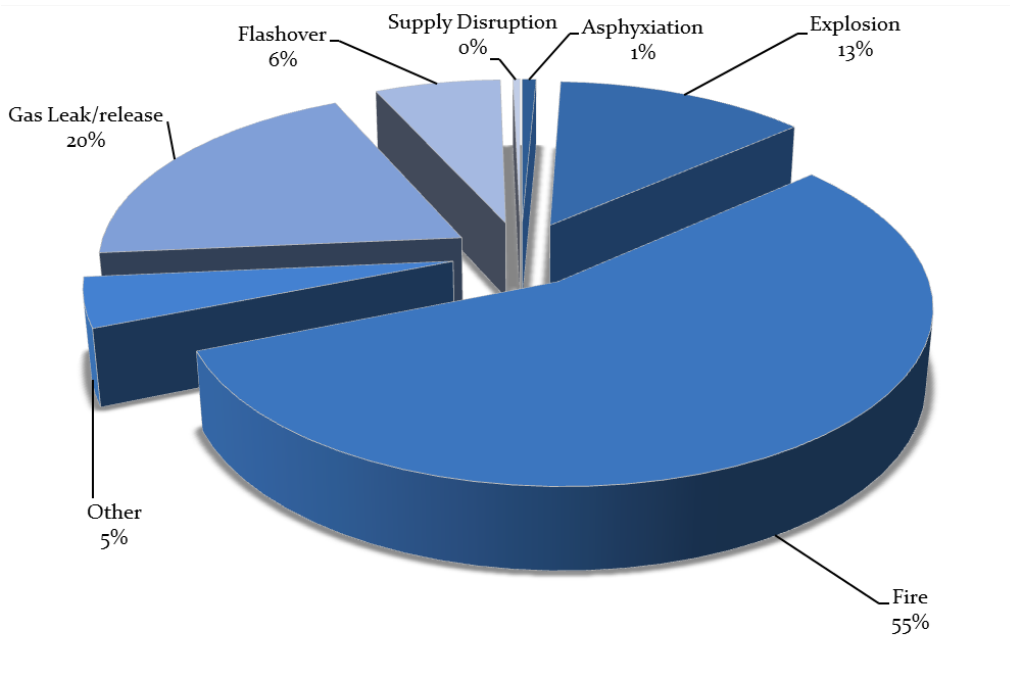
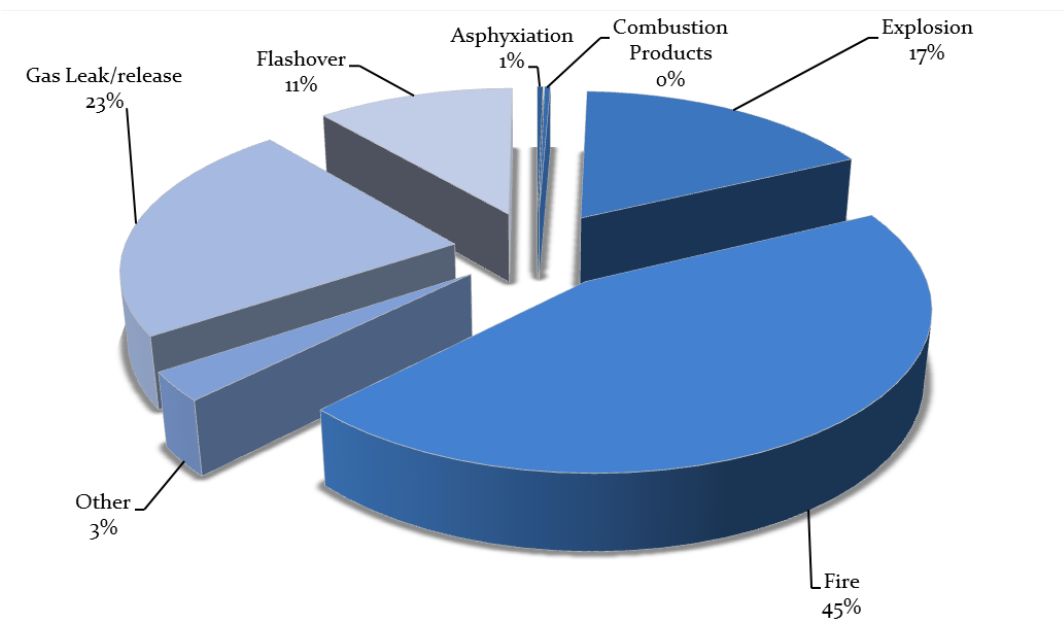
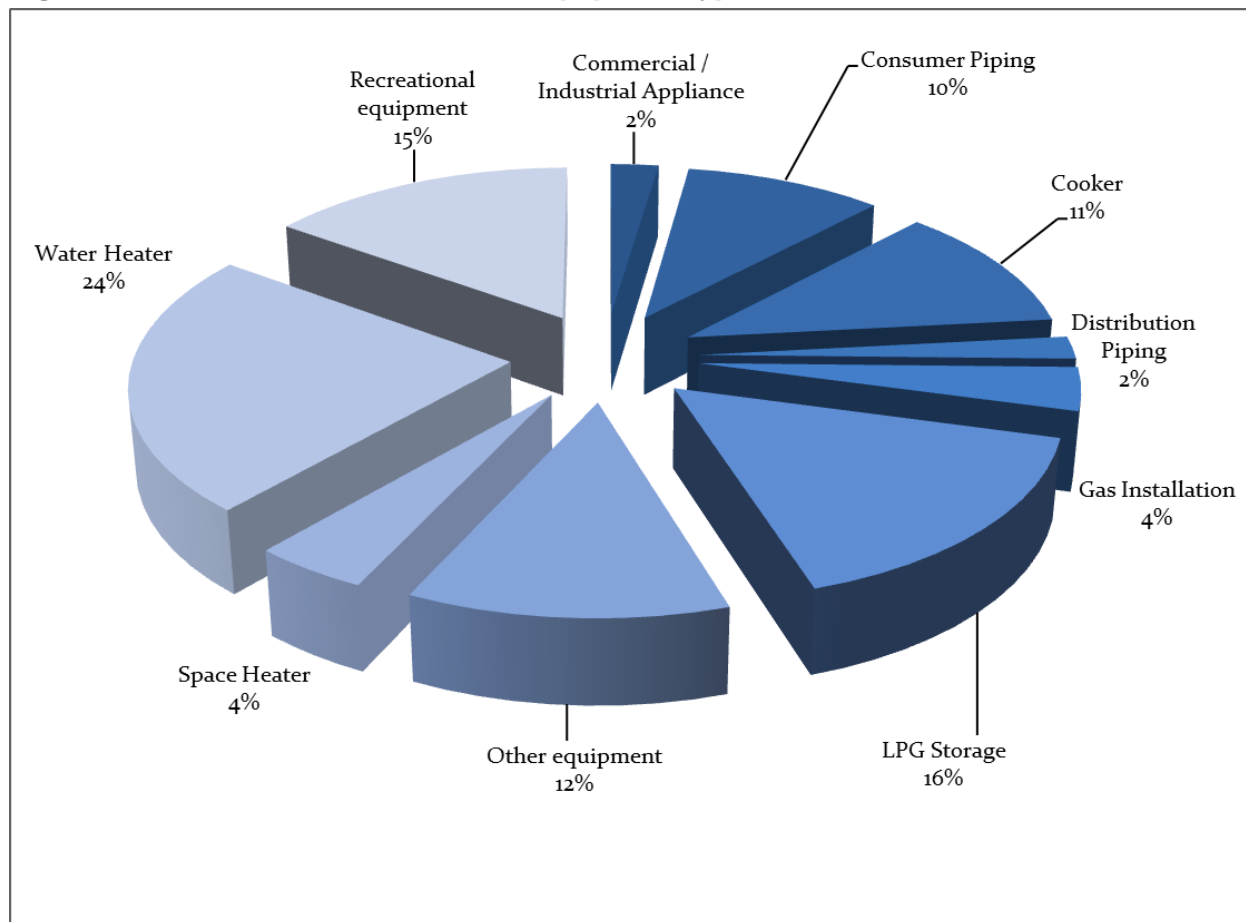


Figure 12: Gas utilisation incidents – Type of incidents resulting from LPG



There is a wide range of equipment/appliances involved in gas utilisation incidents as shown in Figure 13 below.

Figure 13: Gas utilisation incidents – Equipment type



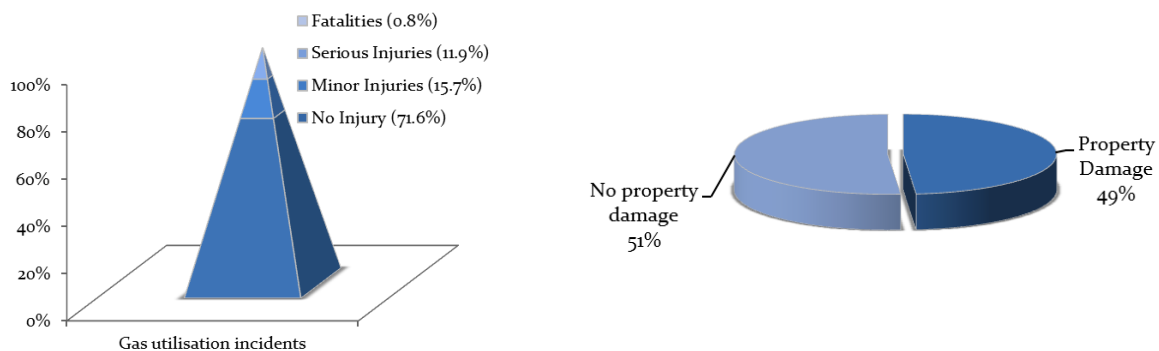
The most common types of equipment found in utilisation incidents are water heaters (hot water systems) accounting for 24% of the incidents. This was followed by LPG (storage) cylinders at 16% and recreational equipment (which includes gas barbeques) at 15%.

Most incidents involving water heaters occurred while lighting the pilot light.

Component failure was also found to be the cause in the majority of LPG storage incidents and in incidents involving recreational equipment like barbeques.

From 2005/06 to 2014/15, in the area of gas utilisation, 0.8% have resulted in fatalities, 11.9% in serious injury requiring hospitalisation, 15.7% resulting in minor injuries and 71.6% did not result in any injury.

Figure 14: Gas utilisation incidents – Incidents resulting in fatality, injury, hospitalisation or property damage



The same data set has been analysed in terms of damage to property, with an almost even split between incidents resulting in some kind of property damage and those with no impact to property.

Gas supply

Gas supply incidents

There were 211 gas supply incidents recorded during the reporting period from 2005/06 to 2014/15. In contrast to gas utilisation incidents, the majority of gas supply incidents occurred within the workplace. Figure 15 displays the number of workplace and non-workplace incidents, with workplace incidents amounting to 82% of all recorded supply incidents.

Figure 15: Gas supply incidents – Workplace and non-workplace

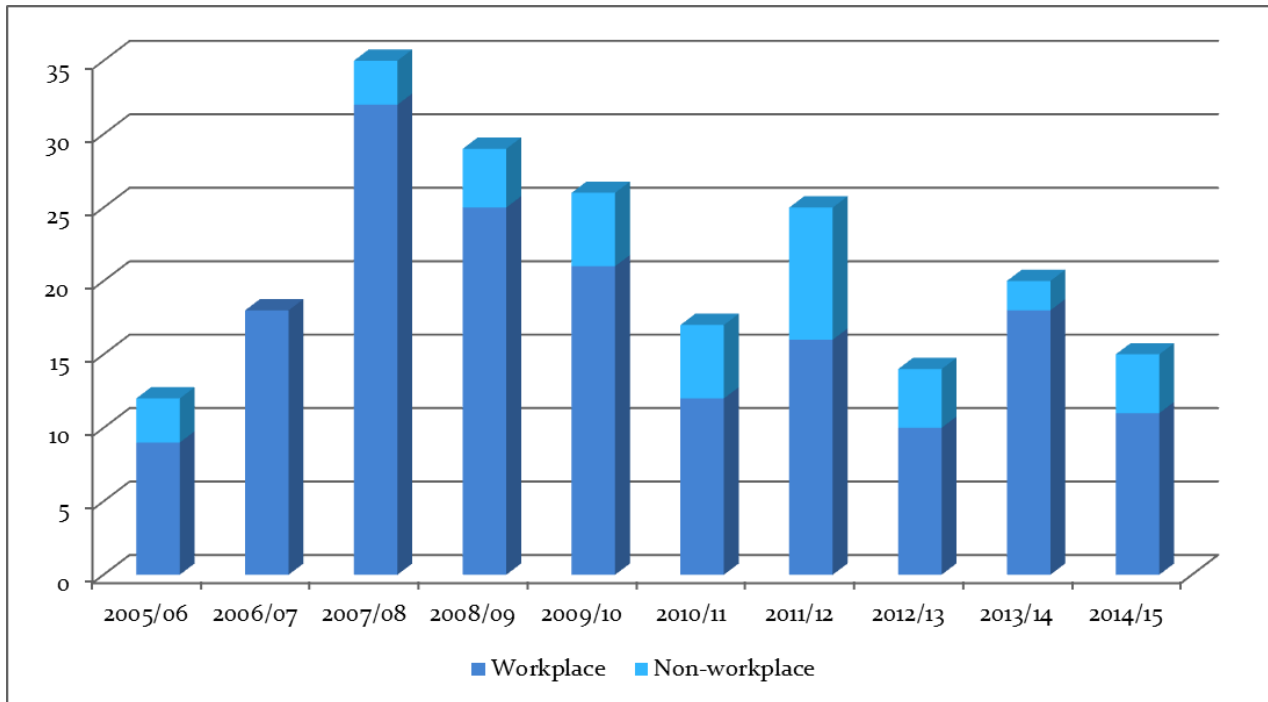
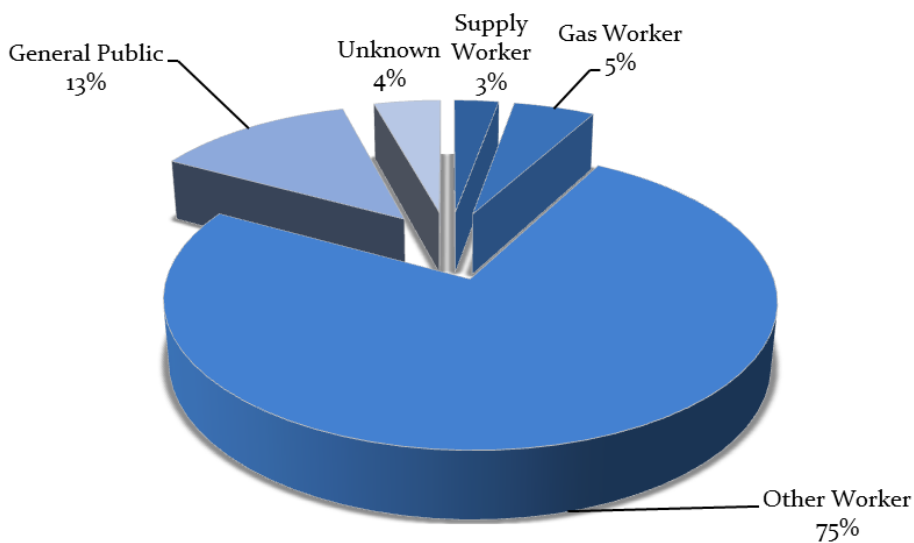


Figure 16 illustrates that supply workers were involved in just 3% of the incidents and gas workers in 5%. Workers from other occupations were found to be involved in 75% of incidents and approximately 13% affected the general public.

Figure 16: Gas supply incidents – Workers and general public



Gas supply incidents – by type of gas

Analysis of the type of gas found in recorded supply incidents reveals 94% of incidents involved NG. In comparison, incidents involving LPG accounted for 6% as displayed in Figure 17 below. This may be reflective of the market size of each category. Figure 17A shows the percentage of consumers for NG and LPG.

Figure 17: Gas supply incidents – Type of gas

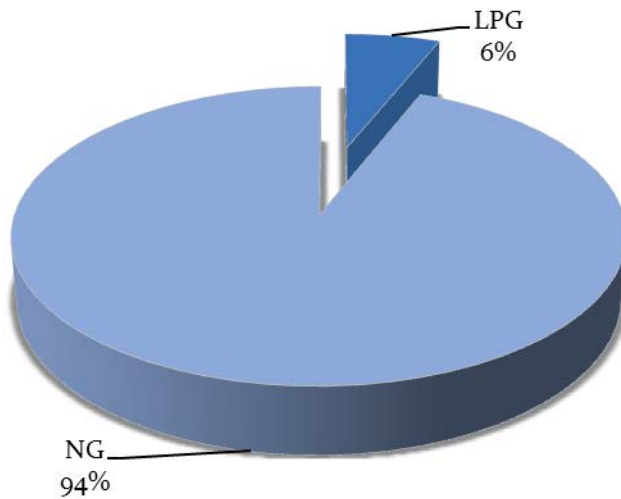


Figure 17A: Gas supply incidents – Percentage of consumers by type of gas

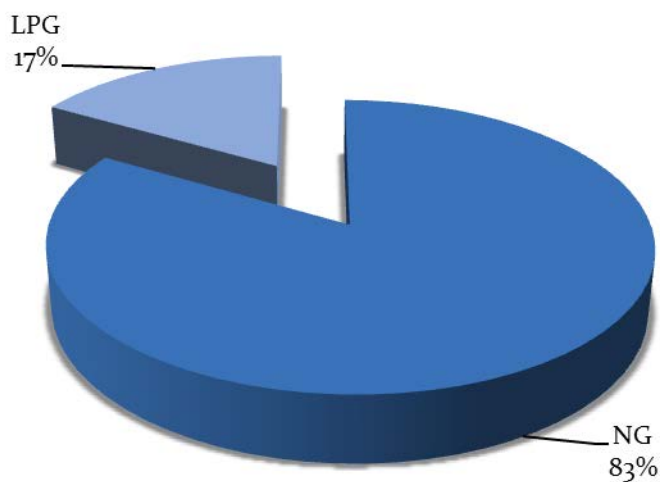


Figure 18 below indicates that 80% of incidents resulted in a gas leak or release and 14% resulted in a fire.

Figure 18: Gas supply incidents – Type of incidents resulting from NG

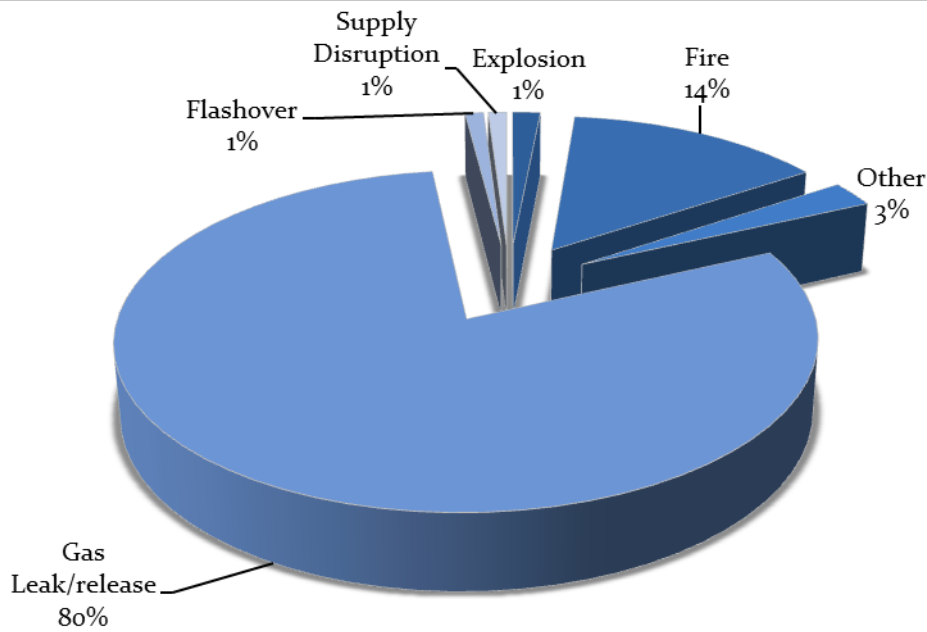


Figure 19 below provides an overview of the types of incidents resulting from LPG but they are minimal in number when compared to natural gas.

Figure 19: Gas supply incidents – Type of incidents resulting from LPG

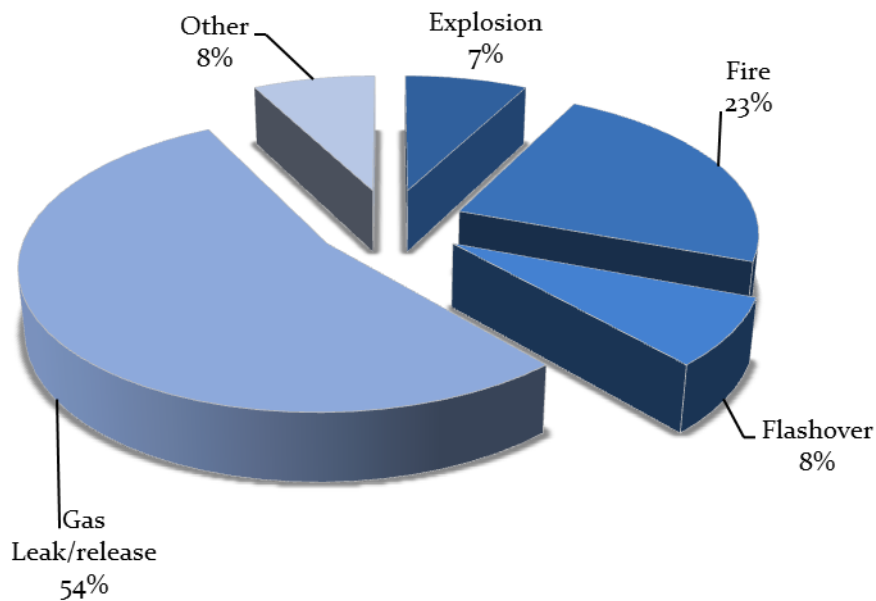


Figure 20 below is an analysis of the type of equipment found in gas supply incidents. It was found that gas piping was a factor in 84% of the incidents. These incidents largely related to accidentally damaging piping when excavating.

Figure 20: Gas supply incidents – Equipment type

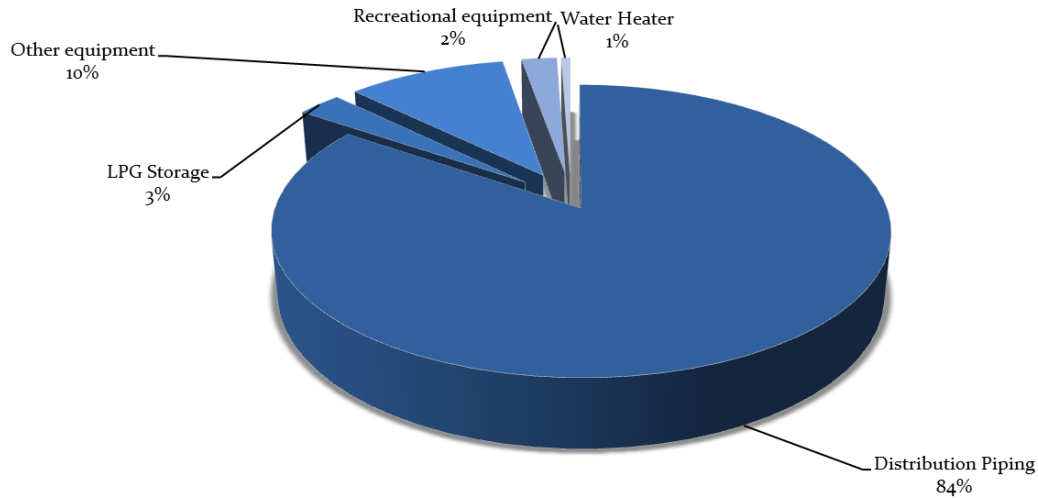
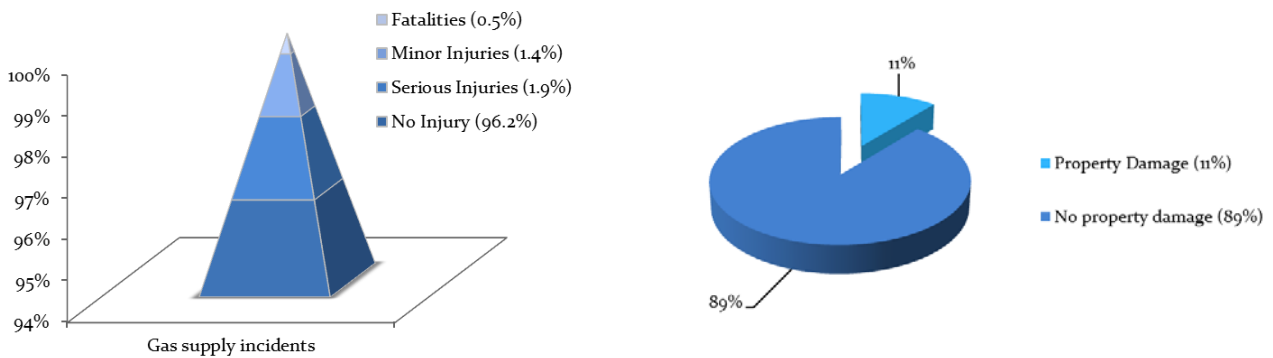


Figure 21 below is an indication of the injury types sustained in supply incidents. There were no fatalities recorded in gas supply incidents until 2012/13 when there was one fatality.

Of all gas supply incidents, 1.9% resulted in hospitalisation and 1.4% in minor injuries. The large majority of 96% of incidents have resulted in no injury. 11% of incidents resulted in damage to property.

Figure 21: Gas supply incidents – Incidents resulting in fatality, injury, hospitalisation or property damage



Conclusion

The fatal accident frequency rate is declining over the reporting period, but there is an increasing trend in the area of serious injury. Cookers, recreational equipment and hot water systems were found to be most commonly involved in incidents resulting in serious injury. Trends for minor injuries show a decreasing rate over the reporting period.

Analysis of gas utilisation incidents shows that the majority of incidents occur in a non-workplace environment, with natural gas being the primary gas source. The most common types of equipment found in utilisation incidents are water heaters (hot water systems), followed by LPG (storage) cylinders and recreational equipment. Component failure and lack of maintenance were the common causes of most utilisation incidents indicating that more information or education in this area may be necessary to prevent such incidents. Over the reporting period there were not many incidents related to auto gas or butane. However, lunch box cookers with butane canisters pose a safety risk. This was evident where an incident resulted in four people being seriously injured.

Gas supply incidents show the inverse of utilisation with the majority occurring in a workplace environment. Gas workers accounted for just 5% of these incidents and workers from other occupations accounted for approximately 75% of these incidents. The majority of these incidents are the result of third party strikes or damage to the network by people not residing at the premises nor the owner of the network. Most gas supply incidents resulted from damaged piping due to excavations or people digging and inadvertently hitting a gas pipe. Overall, supply incidents have a higher safety outcome compared to utilisation.