



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

# Gas Incident Safety Report Western Australia 2012-13





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## PREFACE

This report by EnergySafety summarises information about gas incidents in Western Australia and analyses statistical trends for the years 2003/04 to 2012/13.

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

June 2014

## EXECUTIVE SUMMARY

This report is an analysis of gas incidents reported to EnergySafety over a ten year period from 1 July 2003 to 30 June 2013.

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 819 gas related incidents reported in the ten years from 2003/04 to 2012/2013. 78% of these incidents occurred in the metropolitan area. An analysis of workplace and non-workplace incidents indicates that 44% of incidents occurred in the workplace.

Six gas related fatalities occurred over the reporting period. The very nature of gas incidents can result in multiple fatalities as was the case in 2006/07 when an incident involving a camping stove being used indoors resulted in the death of 3 people.

There was a fatality in 2012/13. The fatal incident occurred when LPG was 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 this 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.

On average one fatal gas incident has occurred every three years.

There were ten incidents which resulted in serious injury in 2012/13 bringing the total number of incidents in this category to 61 since 2003/04. Since 2003/04, 104 incidents resulted in minor injury, of which 11 occurred in 2012/13.

Interstate comparisons using the Fatal Accident Frequency Rate (FAFR) shows that WA has the fourth highest rate when compared to the other States and Territories of Australia and New Zealand.

This report analyses gas incidents in relation to gas utilisation and supply. Nearly 74% of incidents were reported in gas utilisation. Overall gas supply incidents recorded by EnergySafety have shown a higher safety outcome as compared to gas utilisation.

## 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 and additional data sourced from regulatory jurisdictions in other States and Territories of Australia and New Zealand. 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 2003/04 to 2012/13.

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 thanks the regulatory jurisdictions of the States and Territories of Australia and New Zealand for their contribution to this report.

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**

ACT – Australia Capital Territory

AUS – Australia

FAFR – Fatal Accident Frequency Rate

GTRC – Gas Technical Regulators Committee

LPG – Liquid Petroleum Gas

NG – Natural gas

NT – Northern Territory

NZ – New Zealand

PMP – per million population

SA – South Australia

TAS – Tasmania

VIC – Victoria

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 10<sup>6</sup>. This figure allows a comparison of gas safety performance against other jurisdictions.

### 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 m<sup>3</sup> or more of gas or the unplanned and uncontrolled release in the open air of 1,000 m<sup>3</sup> or more of gas.

### Limitations of this report:

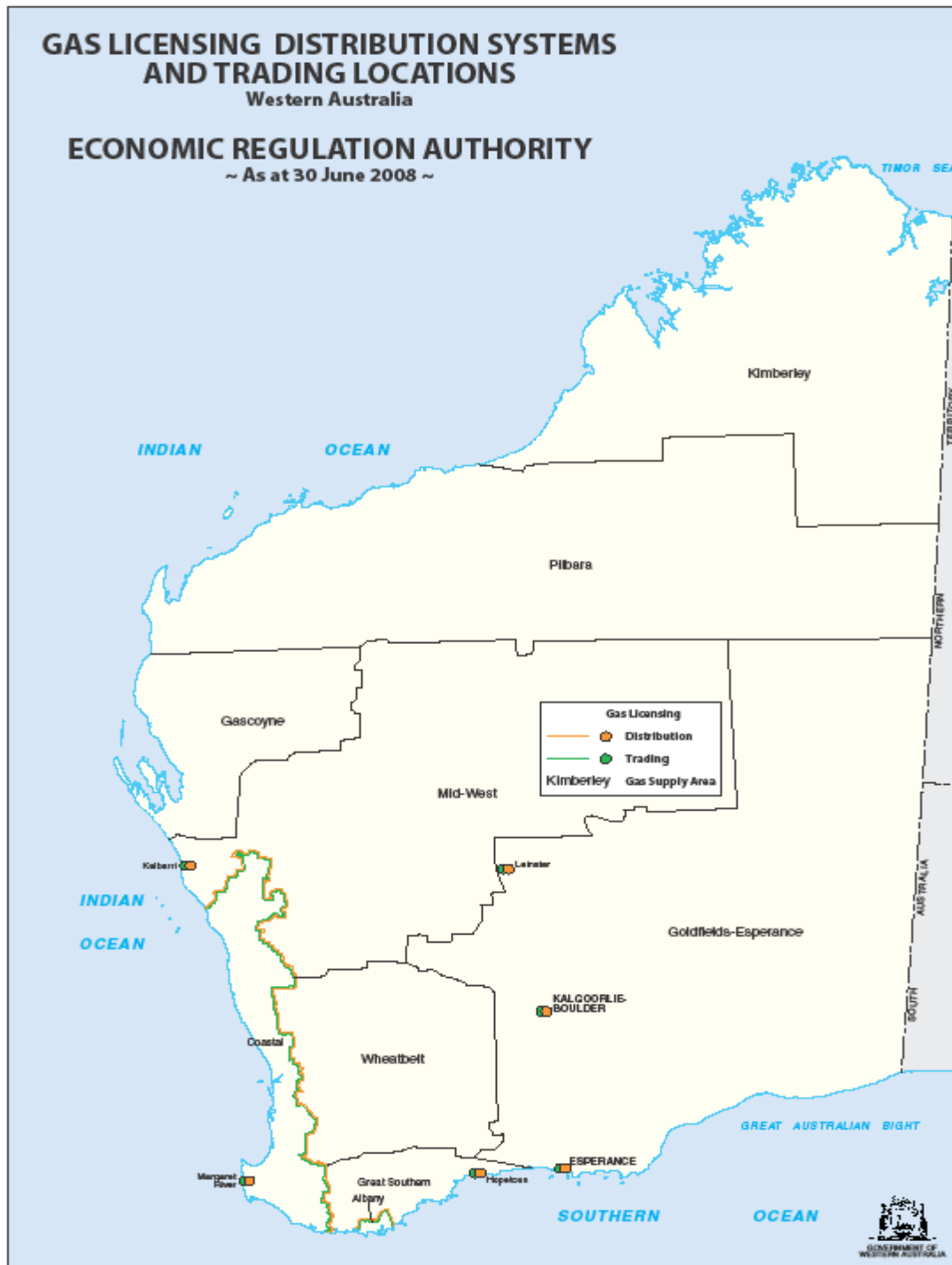
- This report is based on information derived from rigid legacy systems due for replacement in the near future. Parts of the data have been manually noted and then summarised for analysis. While care has been taken in the process of documenting this report, the risk of human error is still present.
- 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 EnergySafety. 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 compare the FAFR with those of other jurisdictions, 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 Australia<sup>1</sup>



## GAS INCIDENTS RECORDED IN WA

There were 819 gas related incidents reported from 2003/04 to 2012/13. The number of reported incidents per million population has been represented in Figure 2 below. The most number of incidents were reported in 2007/08 and although there has been a variation in the numbers reported the overall trend has been declining at a steady rate indicating a positive outlook for gas safety.

**Figure 2: Number of WA gas related incidents per million population – 2003/04 to 2012/13**

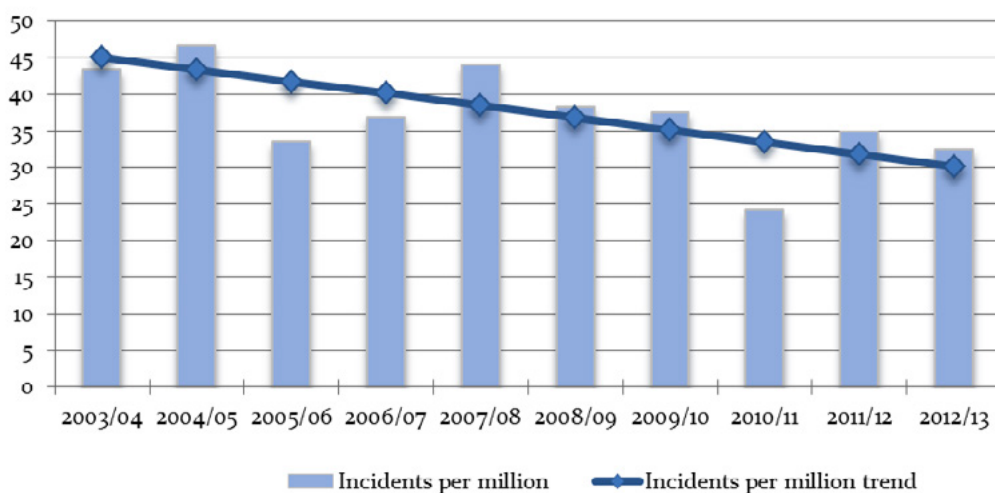
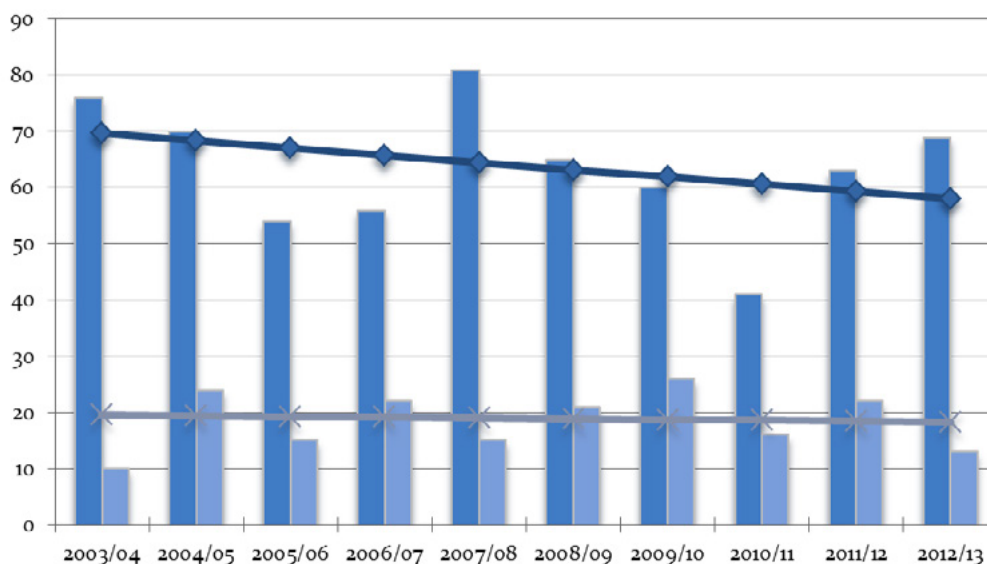


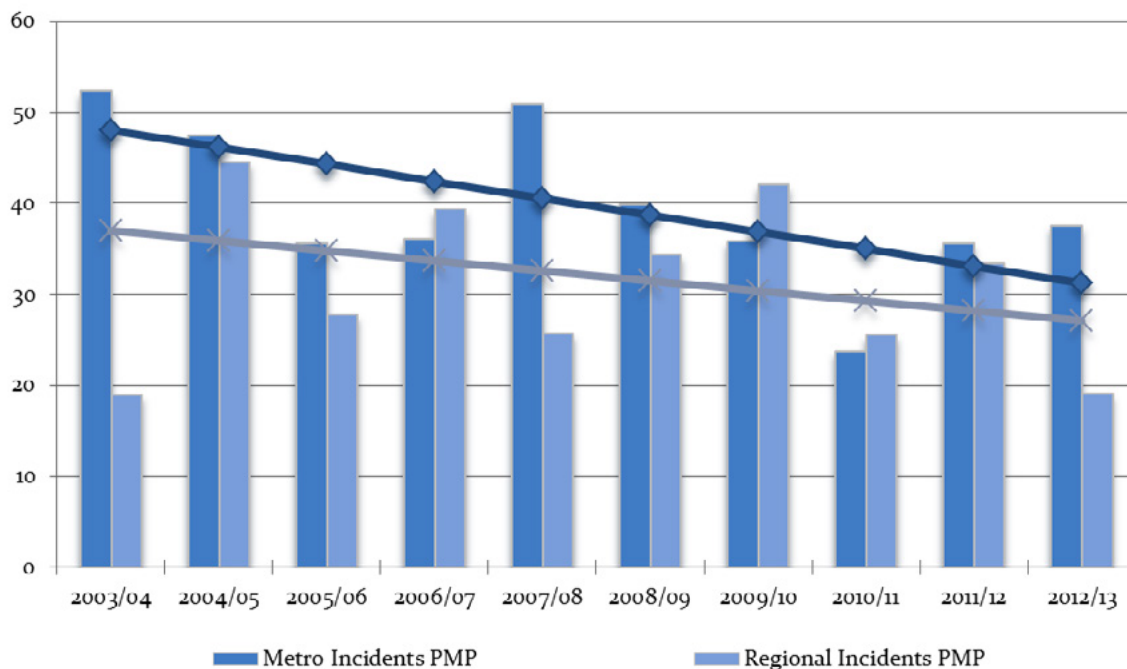
Figure 2A below shows a decreasing trend for incidents within the metropolitan area and a steady trend for incidents in regional areas. This trend indicates a decline in incidents for areas despite an increasing population in Western Australia. The metropolitan area recorded the highest number of incidents in 2007/08 and the regional areas recorded the highest in 2009/10.

**Figure 2A: Number of incidents in metro and regional areas – 2003/04 to 2012/13**



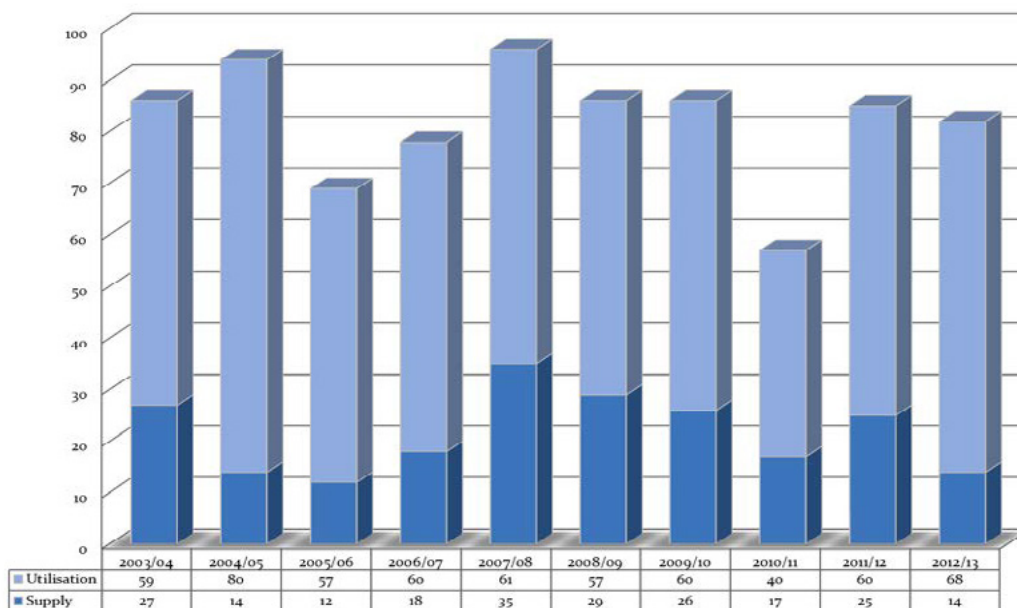
The number of incidents per million population individually in metropolitan and regional areas is depicted in Figure 2B below. The trend for incidents per million population for both metro and regional areas appears to converge but is decreasing.

**Figure 2B: Metropolitan and regional incidents per million population – 2003/04 to 2012/13**



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. This may be due to the legislative requirement that all utilisation incidents must be reported. 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 – 2003/04 to 2012/13**



## FATALITIES

From 2003/04 to 2012/13 there have been four fatal incidents that resulted in six fatalities.

In 2003/04, the fatality which occurred in a retirement village was the result of combustible material igniting within the lounge room from being too close to a portable gas heater. It is believed the deceased had died of smoke inhalation.

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 this house in Karrinyup. The three deceased were found in a bedroom unable to escape the fire in that portion of the house.

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 2012/13. The fatal incident occurred when LPG was 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 this 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.

**Figure 4: Fatalities and fatal incidents**

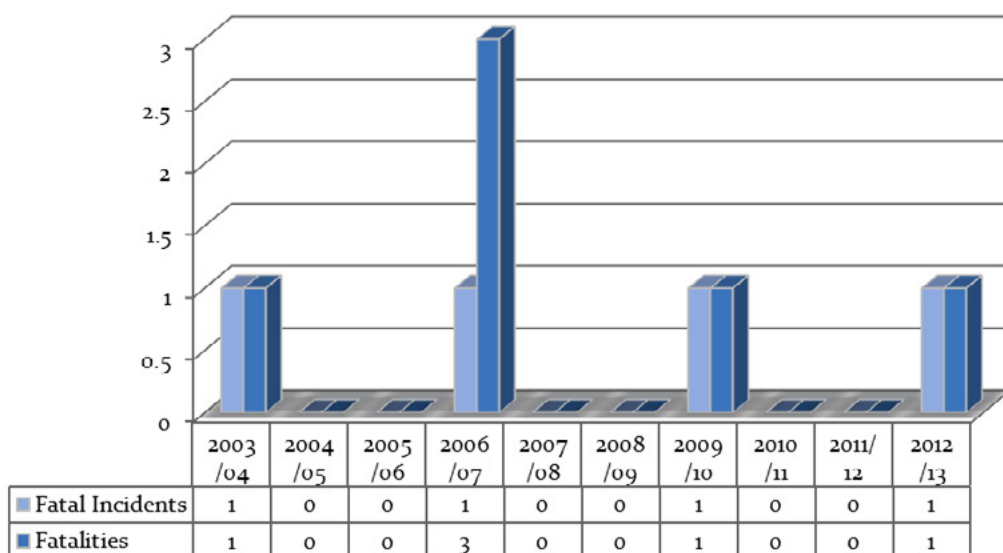


Figure 4 shows that fatalities arising from gas incidents may impact more than one person in a single incident as is evident from the incident which occurred in 2006/07 involving a camping stove fatally affecting three people.

**Figure 5: Fatalities per million population**

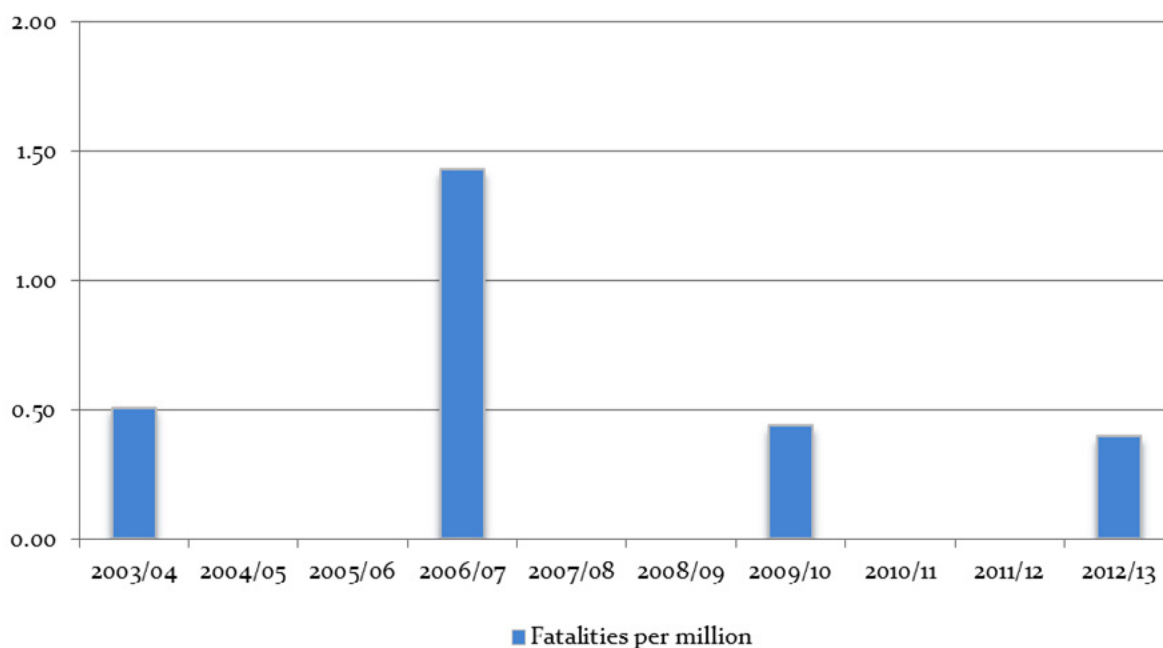


Figure 5 above provides a view of the number of fatalities per million population. On average one fatal gas incident has occurred every three years.

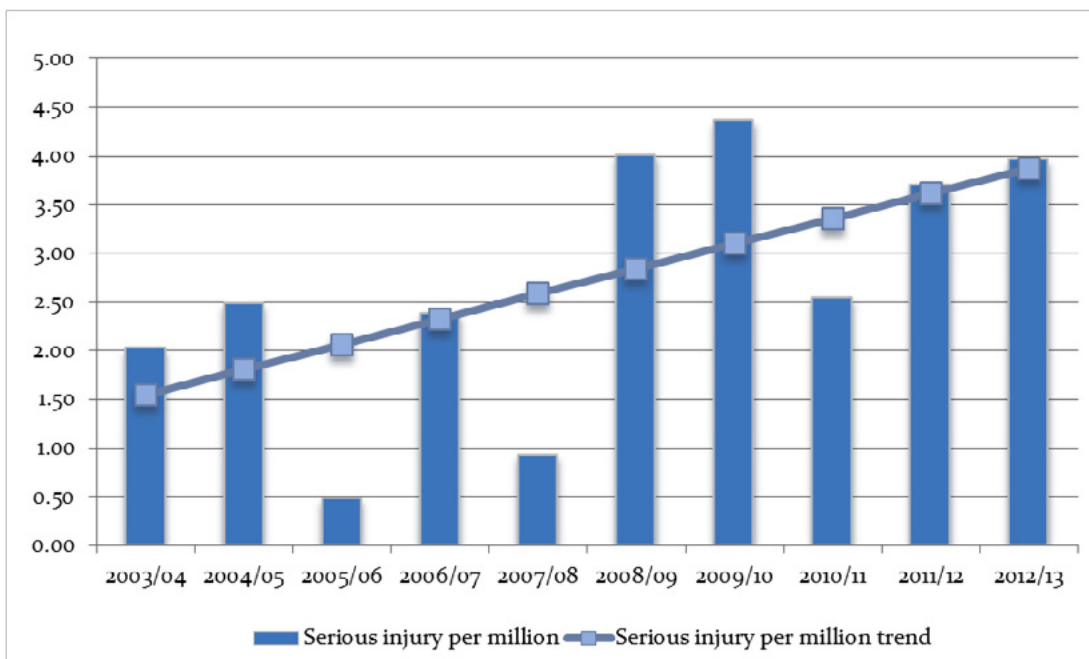
A fatality involving a gas worker carrying out an operation on the gas distribution system occurred in 2007/08. The findings of the coroner indicated that the gas fitter died from natural causes and the fatality was not gas related. This fatality has not been included as part of this report.

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. Although the trend shows a gradual increase in the number of such incidents, it is influenced by the peaks in 2008/09 and 2009/10. Further analysis would indicate if there is a possible need to focus on safety in this area.

**Figure 6: Serious Injury per million population**



The majority of incidents resulting in serious injury involved cookers, water heaters and LPG storage systems.

Incorrect installation and operational defects were found to be the cause in most incidents involving gas cookers. In the case of water heaters, operational defects were primarily found to be the cause.



**Figure 6A: Serious Injury per million population by region**

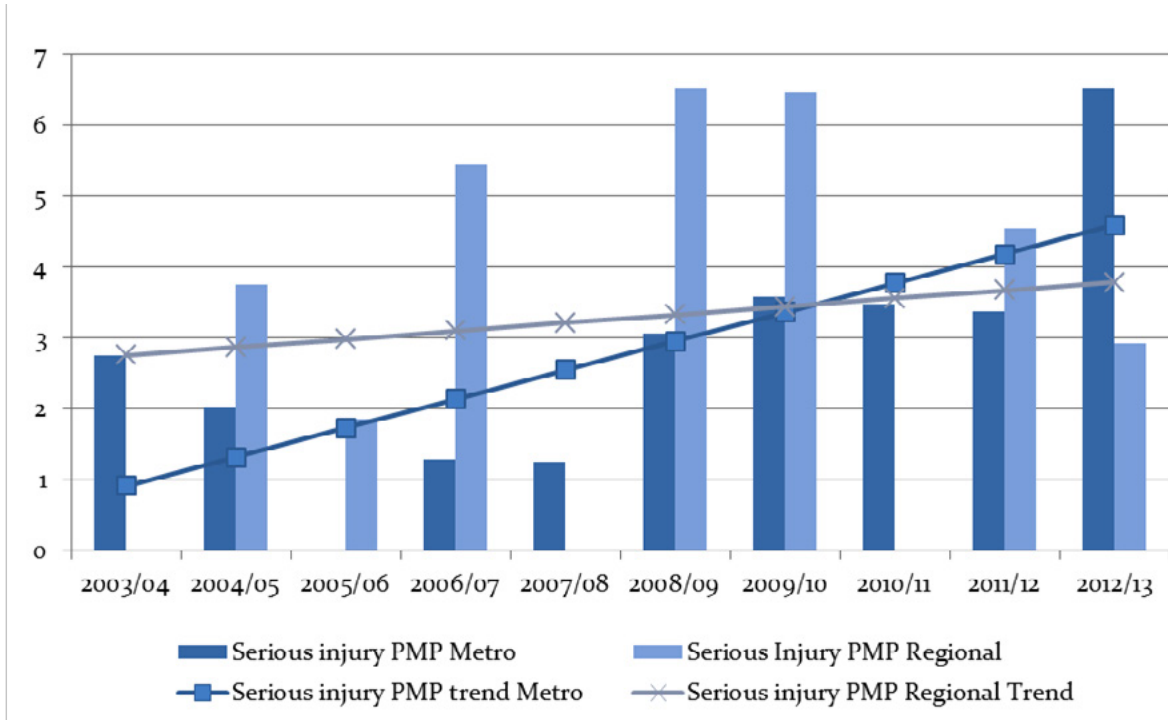
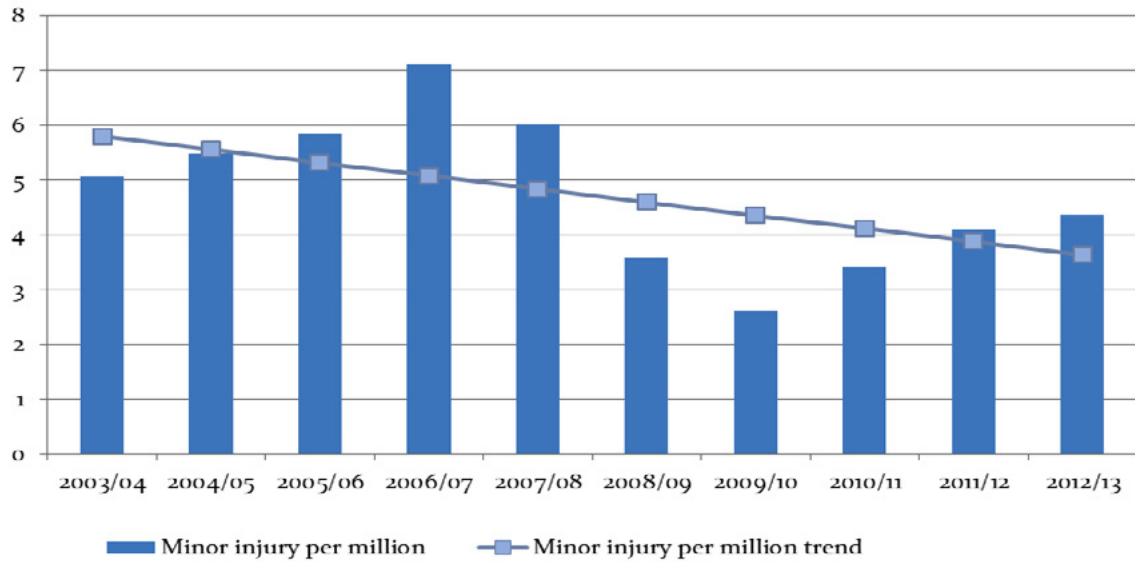


Figure 6A shows the distribution of incidents resulting in serious injury across metropolitan and regional areas. The data suggests that there were higher number of such incidents in regional areas, but the number of such incidents has been decreasing since 2010/11. Incidents in the metropolitan area have been fairly constant with a spike in 2012/13.

## MINOR INJURY

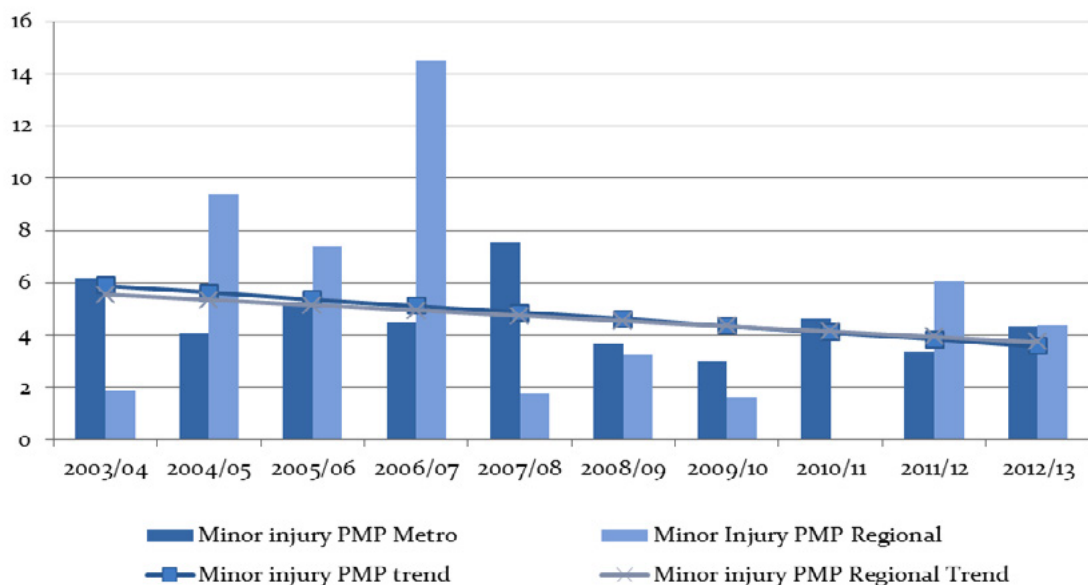
Minor injuries resulting from gas incidents show a decreasing trend over the reporting period with a slight increase in the number of incidents in the last two years as indicated in Figure 7.

**Figure 7: Minor Injury per million population**



The rate for such incidents in the metropolitan area has been relatively constant and the rate for regional areas has been decreasing with a slight increase in the last two years and is now almost equivalent to the rate for metropolitan incidents.

**Figure 7A: Minor Injury per million population by region**



## INTERSTATE COMPARISONS

Benchmarking values have been used in this document to compare Western Australia's (WA) performance against interstate and overseas counterparts. It is expected that this will assist WA to develop strategies to improve safety outcomes.

A common benchmark technique used is the Fatal Accident Frequency Rate (FAFR) as a value for comparison.

The FAFR is arrived at using the following factors:

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

For ease of communication, the FAFR is multiplied by a million. Therefore the figure arrived at is the FAFR x 10<sup>6</sup>.

The figures collected over the past ten years can only be utilised for quantitative comparisons because each state and country's approach to gathering and categorisation of information is different. In addition, the number, type of appliance used and the exposure of people to risk also considerably vary from state to state and country to country.

Most jurisdictions reported that there were no fatalities for 2012/13. A comparison has been made by arriving at the FAFR using the average of fatal incidents over the reporting period and the residential population of each area.<sup>2</sup>

**Figure 8: FAFR Table – Australia and New Zealand**

Jurisdiction	Average fatalities 2003-04 to 2012-13	Estimated Population	FAFR x 10 <sup>6</sup>
WA	0.6	2523996	0.24
ACT	0.1	383672	0.26
NSW	0.6	7398775	0.08
SA	0.3	1671844	0.18
VIC	1	5730557	0.17
QLD	0.4	4664270	0.09
TAS	0.3	512529	0.59
NT	0	239491	0.00
AUS	3.1	23123253	0.13
NZ	2.2	4470000	0.49

Although the FAFR for WA is not considered high when compared to other jurisdictions, it is among the top four.

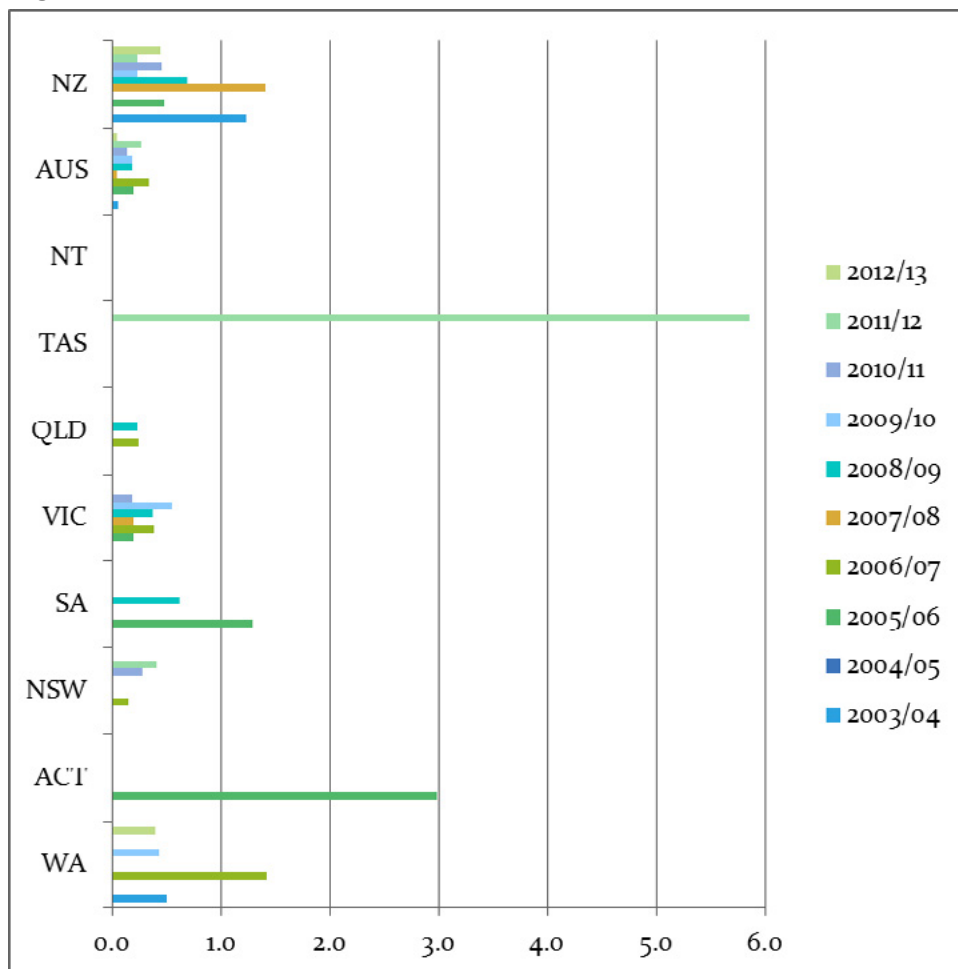
<sup>2</sup> This method of calculating the FAFR is based on the principle that the very nature of gas incidents can affect not only consumers but also other members of the public. Gas incident data for VIC for 2012-13 was not available at the time of preparing this report.

The table below provides information on the fatalities per million in each state over the reporting period. The table below may not be representative of all incidents over the reporting period. The data for the years 2005/06 to 2011/12 has been sourced from information held with the GTRC. Data for 2012/13 has been sourced from each state.<sup>3</sup>

**Figure 9A: Fatalities per million table<sup>4</sup>**

Fatalities	WA	ACT	NSW	SA	VIC	QLD	TAS	NT	AUS	NZ
2003/04	0.5								0.1	1.2
2004/05										
2005/06		3.0		1.3	0.2				0.2	0.5
2006/07	1.4		0.1		0.4	0.2			0.3	
2007/08					0.2				0.0	1.4
2008/09				0.6	0.4	0.2			0.2	0.7
2009/10	0.4				0.5				0.2	0.2
2010/11			0.3		0.2				0.1	0.5
2011/12			0.4				5.9		0.3	0.2
2012/13	0.4								0.0	0.4

**Figure 9B: Fatalities per million - 2003/04 to 2012/13**



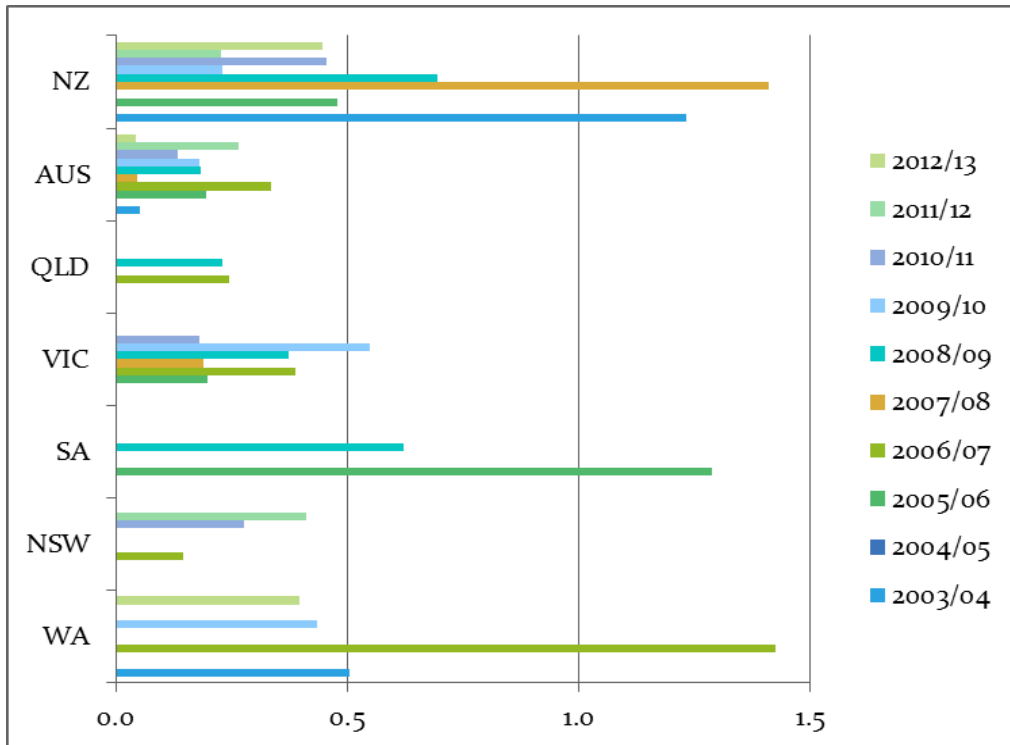
<sup>3</sup>The data reported for New South Wales may not be representative of all incidents in the State.

As 2012/13 data for Victoria was not available at the time of preparing this report, this graph assumes that there were nil fatalities for this jurisdiction in the year.

<sup>4</sup> Blank cells reflect no fatalities for the state, with the exception of Victoria (data unavailable) and New South Wales (data not representative of all incidents)

The Australian Capital Territory and Tasmania had one reported incident each over the past ten years. The Northern Territory has no reported incidents. The population in these jurisdictions is comparatively smaller compared to the other jurisdictions. The chart below excludes these three jurisdictions to provide a more distinct view of the fatalities per million in the remaining jurisdictions.

**Figure 9C: Fatalities per million - 2003/04 to 2012/13**  
(Excluding ACT, NT and TAS)





# GAS UTILISATION

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## GAS UTILISATION INCIDENTS

There were 602 gas utilisation incidents reported during the period 2003/04 to 2012/13. Approximately 31% occurred within a workplace setting and the remainder within the larger community. Figure 10 below shows the distribution between workplace and non-workplace incidents over the past ten years.

**Figure 10: Gas Utilisation Incidents – Workplace and non-workplace**

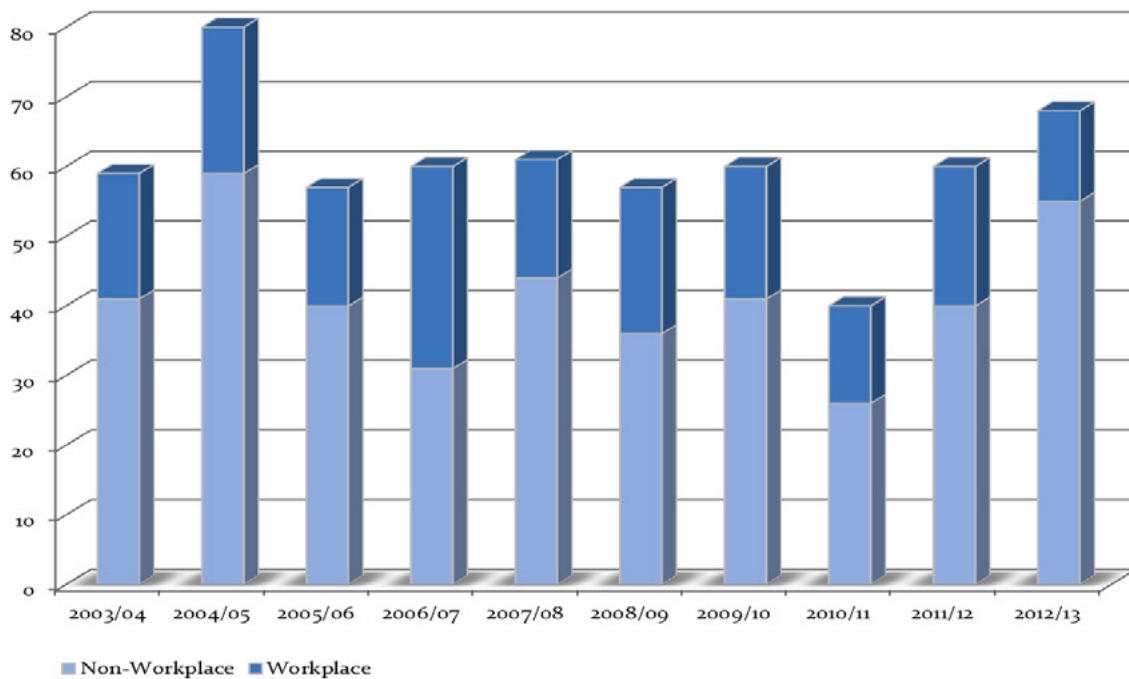


Figure 10A shows the percentage distribution of workplace and non-workplace incidents.

**Figure 10A: Gas Utilisation Incidents – Workplace and non-workplace**

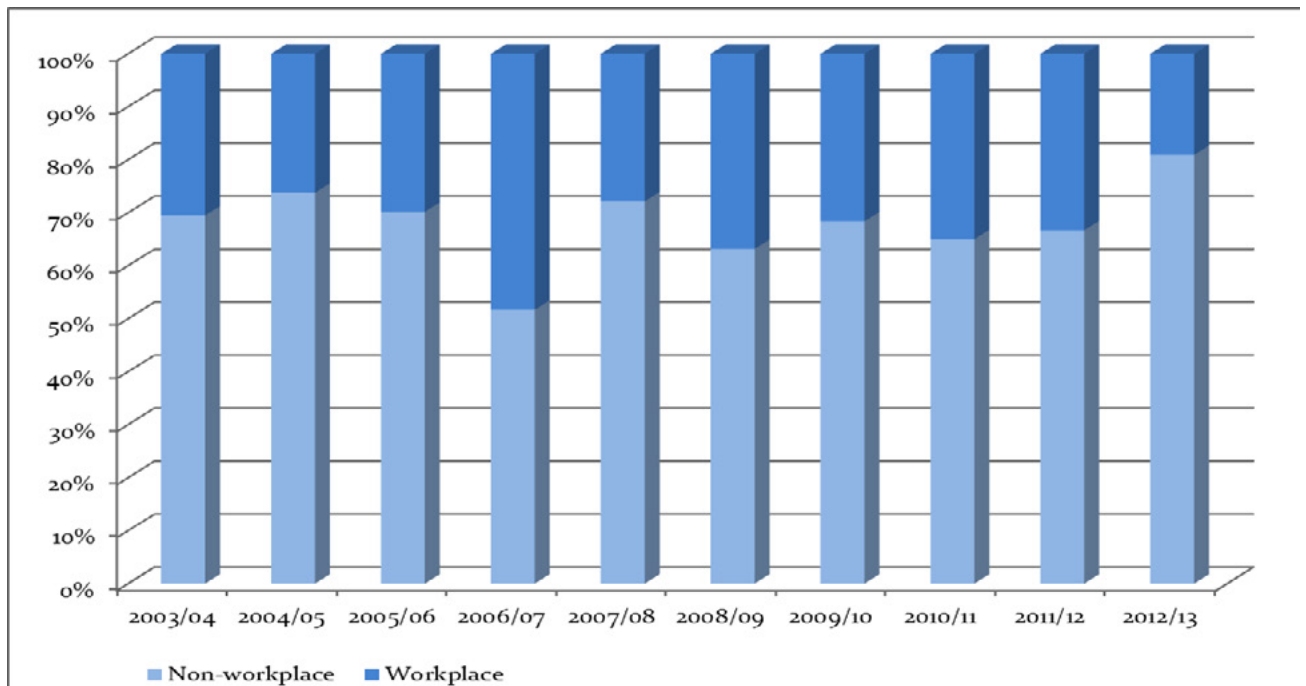
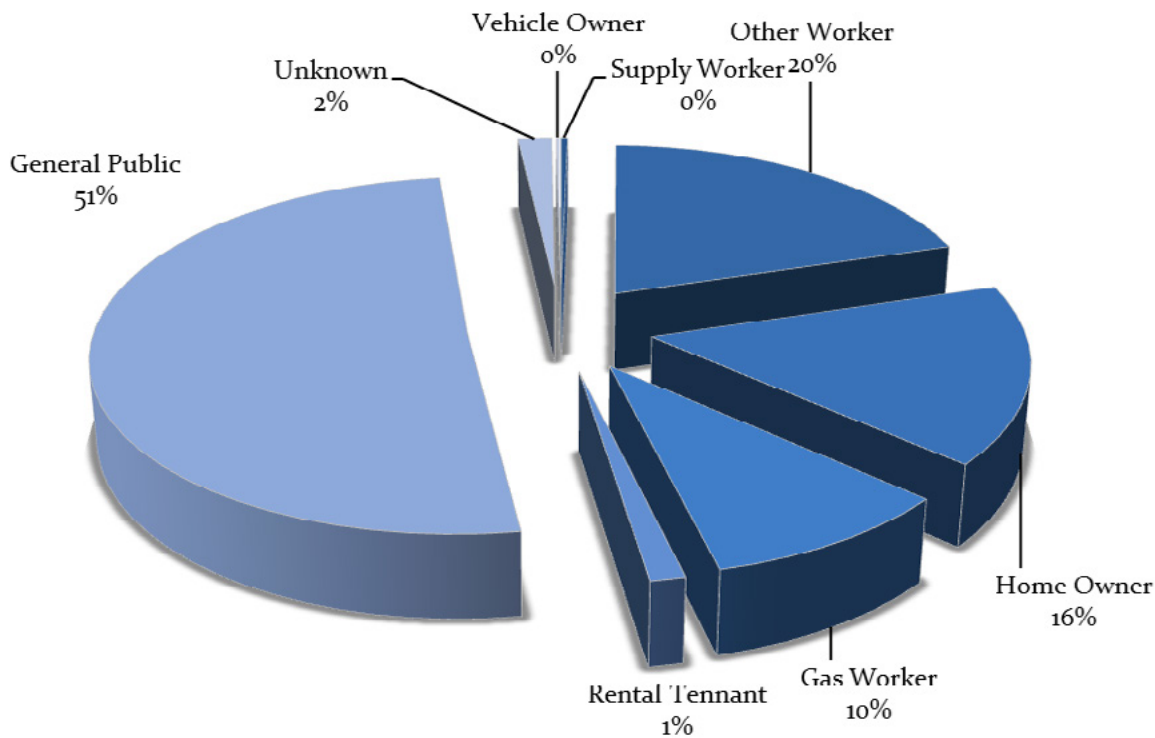




Figure 11 below is a classification of incidents according to broad categories of workers and the general public. Gas fitters were involved in 10% of the incidents and a further 20% affected other workers. Current legacy systems do not contain data to provide further information on the various occupations involving gas incidents and hence an open category of other workers has been utilised in this report.

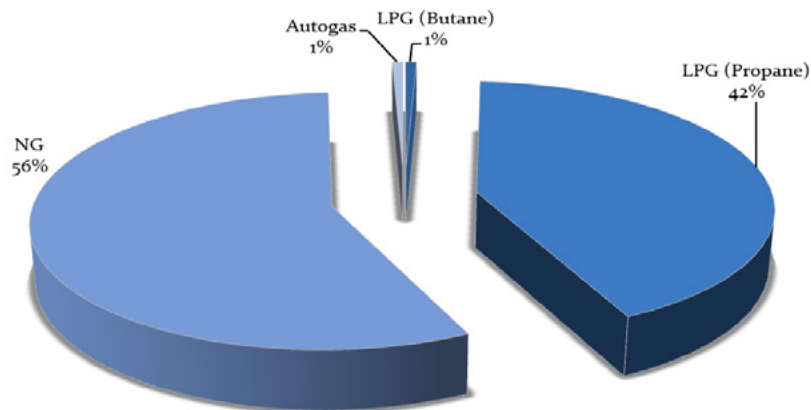
**Figure 11: Gas Utilisation Incidents – Workers versus general public**



## GAS UTILISATION INCIDENTS – BY TYPE OF GAS

Figure 12 below provides a graphical view of the types of gas found in incidents. NG accounts for 56% of the incidents, followed by LPG (Propane) at 42% and LPG (Butane) at 1%.

**Figure 12: Gas Utilisation Incidents – Type of gas**



An analysis of the types of incidents that have occurred reveals that most incidents involving NG result in a fire (57%), followed by a gas leak (19%) and explosions (13%). This breakdown of incident types has not altered by a significant margin over the ten year reporting period. Figure 13 below displays the different categories of incidents resulting from NG. Flashovers and explosions also result in fires, thereby increasing the number of incidents involving a fire to 78%.

**Figure 13: Gas Utilisation Incidents – Type of incidents resulting from NG**

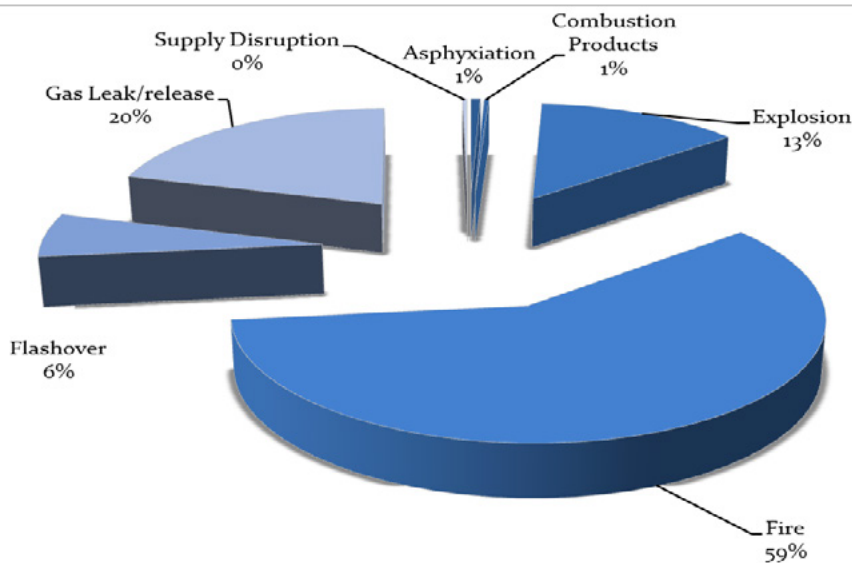
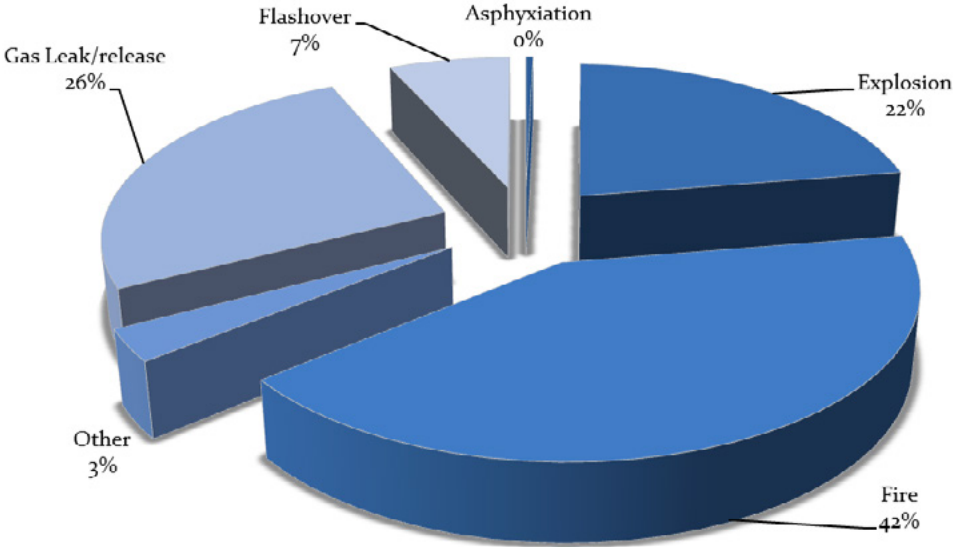


Figure 14 below shows a similar pattern for LPG, fire (42%) is still the primary type of incident, followed by gas leaks (26%) and explosions (22%).

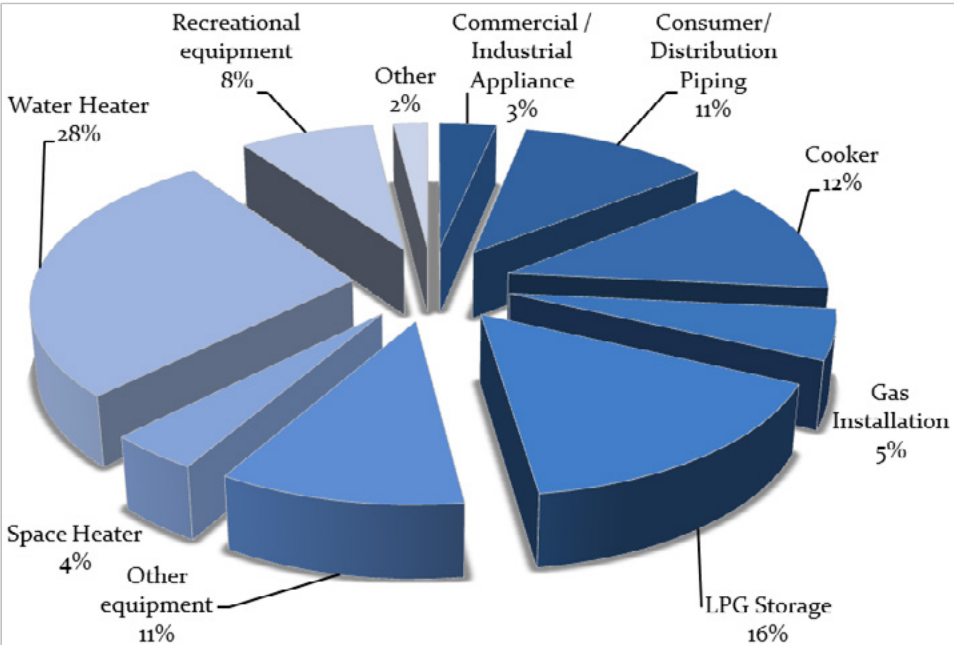
**Figure 14: Gas Utilisation Incidents – Type of incidents resulting from LPG**



As there have been just 4 incidents involving butane and 2 incidents related to auto gas over the ten year period, a graph has not been presented for these incidents.

An analysis of equipment type has revealed that there is a wide range of apparatus involved in gas utilisation incidents as shown in Figure 15 below.

**Figure 15: Gas Utilisation Incidents – Equipment type**



The most common types of equipment found in utilisation incidents are water heaters (hot water systems), accounting for 28% of the incidents. This was followed by LPG cylinders at 16% and gas cookers (including stoves and hot plates) at 12%.

Recreational equipment which includes gas barbeques accounts for 8% of the incidents and consumer / distribution piping at 11%. Further analysis into the causes of incidents in these categories would provide areas of focus for safety programs.

A study of the incidents involving water heaters revealed that most of the incidents occurred while lighting the pilot light. 69% of these incidents resulted in a fire and another 16% in an explosion as indicated in Figure 16 below.

**Figure 16: Gas Utilisation Incidents - Types of incidents involving water heaters**

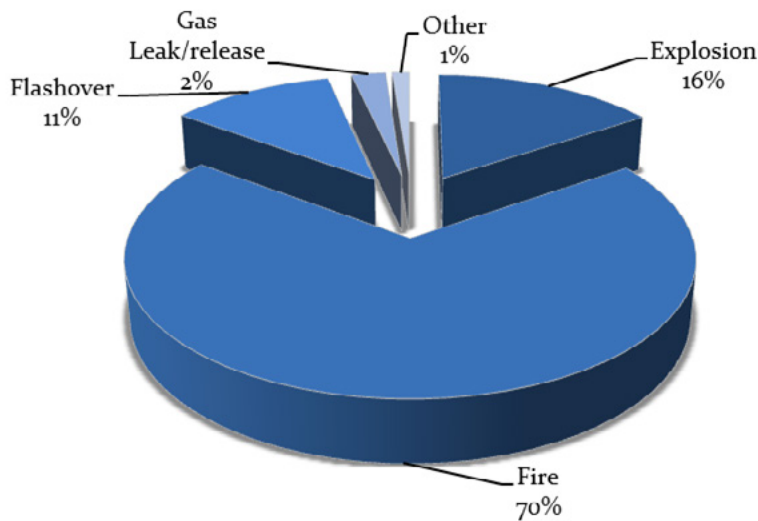


Figure 17 below displays the types of incidents resulting from gas cookers. Fire at 36% is still the highest, followed by explosions, 32% and gas leaks at 19%.

**Figure 17: Gas Utilisation Incidents - Types of incidents involving gas cookers**

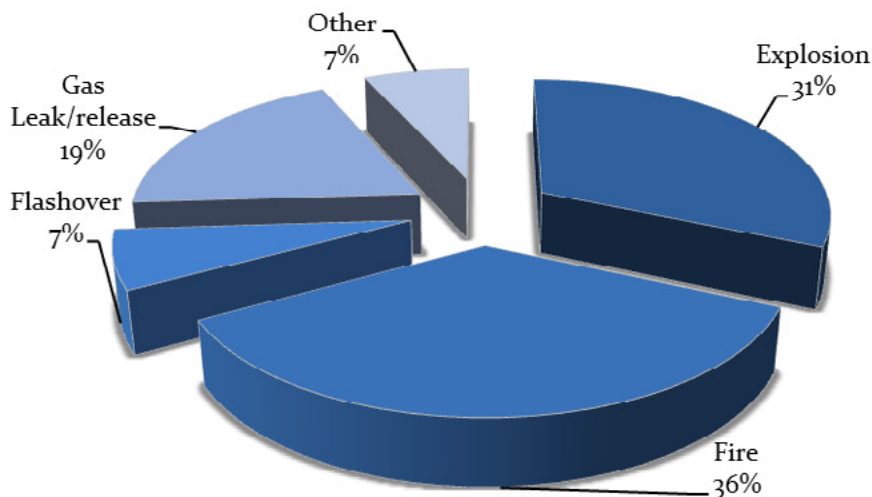
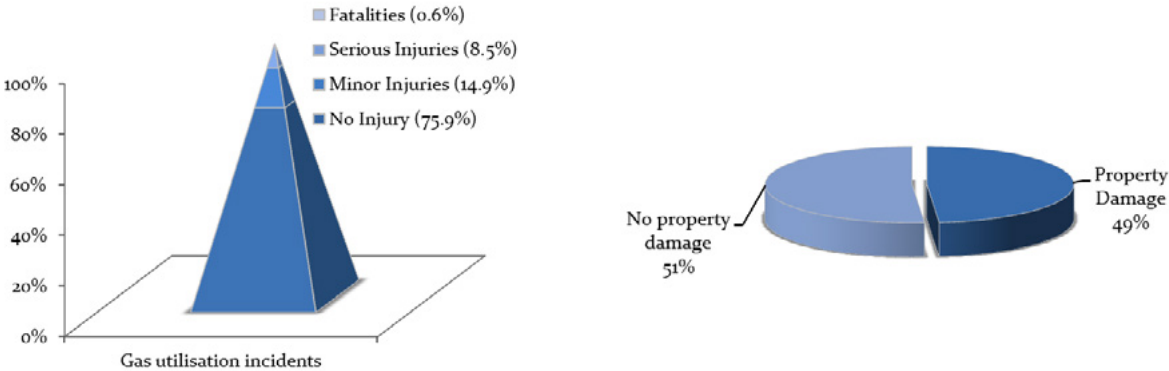


Figure 18 is an analysis of all gas utilisation incidents from 2003/04 to 2012/13 and indicates that 0.6% have resulted in fatalities, 8.5% in serious injury requiring hospitalisation, 15% resulting in minor injuries and 76% did not result in any injury.

**Figure 18: 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

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## GAS SUPPLY INCIDENTS

There were 217 gas supply incidents recorded during the reporting period from 2003/04 to 2012/13. In contrast to gas utilisation incidents, the majority of gas supply incidents occurred within the workplace. Figure 19 displays the number of workplace and non-workplace incidents, with workplace incidents amounting to 79% of all recorded supply incidents.

**Figure 19: Gas Supply Incidents – Workplace and non-workplace**

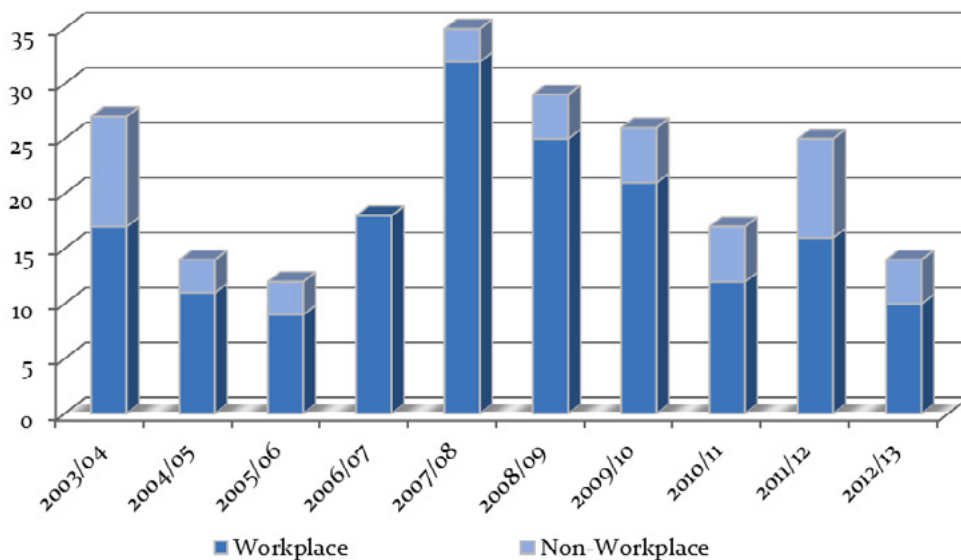
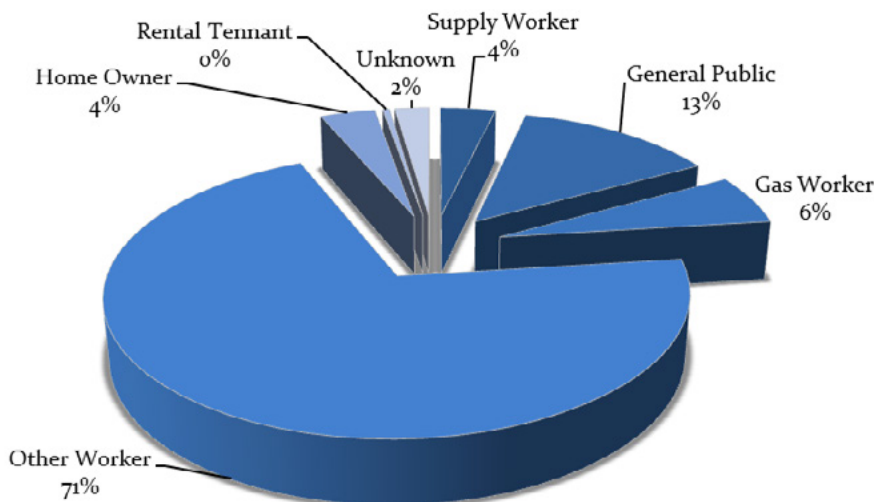


Figure 20 illustrates that supply workers were involved in just 4% of the incidents and gas fitters in 6%. Workers from other occupations were found to be involved in 71% of incidents and approximately 17% affected the general public.

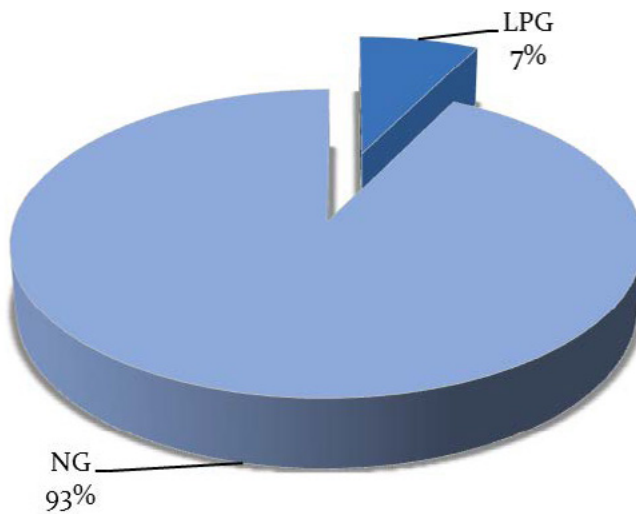
**Figure 20: Gas Supply Incidents – Workers and general public**



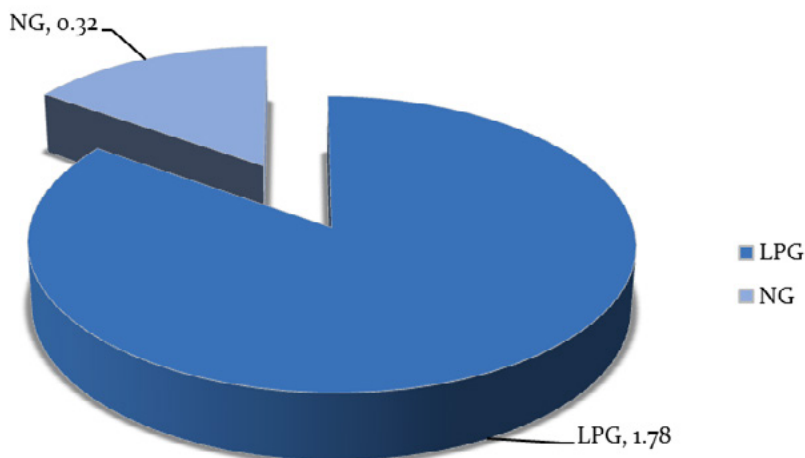
## GAS SUPPLY INCIDENTS – BY TYPE OF GAS

Analysis of the type of gas found in recorded supply incidents reveals that NG was found in 93% of the incidents. In comparison, LPG incidents accounted for 7% as displayed in Figure 21 below. However, this figure may be more representative of the size of the distribution system for NG and LPG. Figure 21A depicts the number of incidents per 1000 customers.

**Figure 21: Gas Supply Incidents – Type of gas**



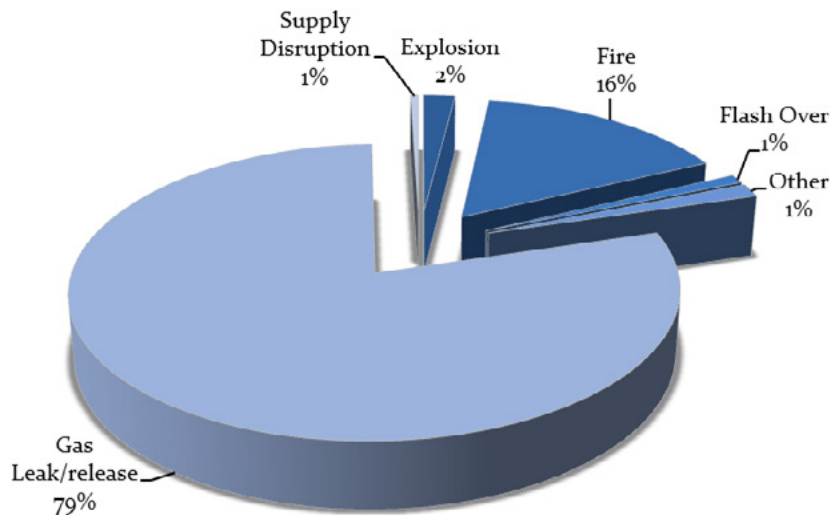
**Figure 21A: Gas Supply Incidents – Number of incidents per 1000 customers.**





Further analysis of incidents involving NG, as per Figure 22 below indicates that 79% of incidents resulted in a gas leak or release. In contrast to gas utilisation at 78%, just 16% of gas supply incidents involving natural gas resulted in a fire. If explosions and flashovers are considered in the category of a fire (as they do result in a fire) this percentage increases to 19%.

**Figure 22: Gas Supply Incidents – Type of incidents resulting from NG**



The types of incidents resulting from LPG supply are similar to those involving NG. It should be noted, however, that there were very few LPG related incidents amounting to 16 incidents over the ten year period. Figure 23 below provides percentages for the different types of incidents but they are minimal in number when compared to natural gas.

**Figure 23: Gas Supply Incidents – Type of incidents resulting from LPG**

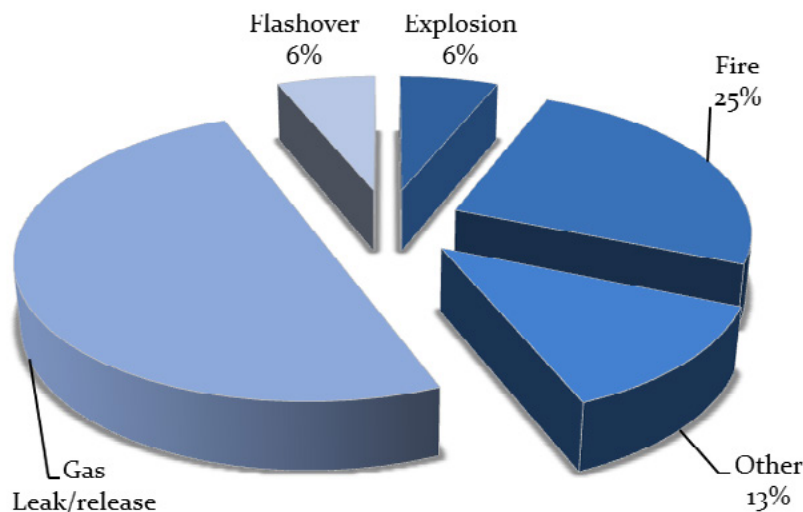


Figure 24 below is an analysis of the type of equipment found in gas supply incidents. It was found that the main gas pipe was a factor in 70% of the incidents. Other incidents involved gas service piping (15%) which incorporates the meter box and the piping from the mains to the meter.

**Figure 24: Gas Supply Incidents – Equipment type**

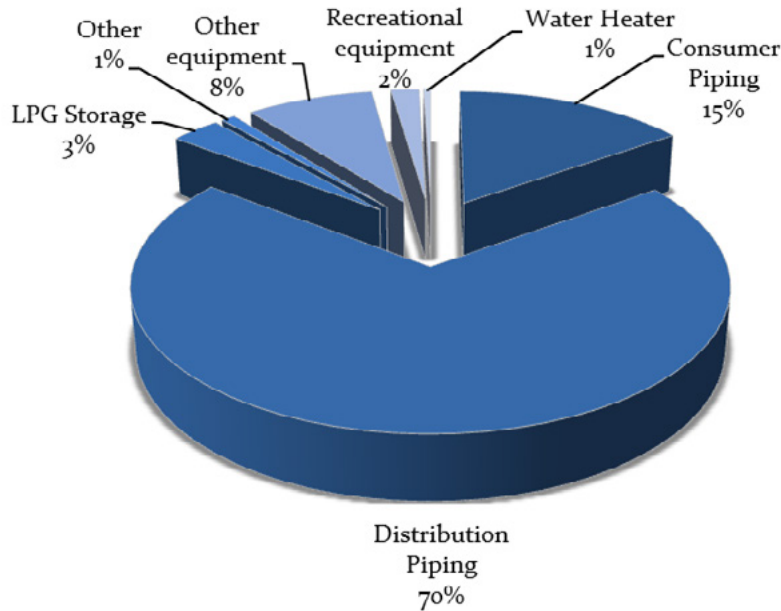
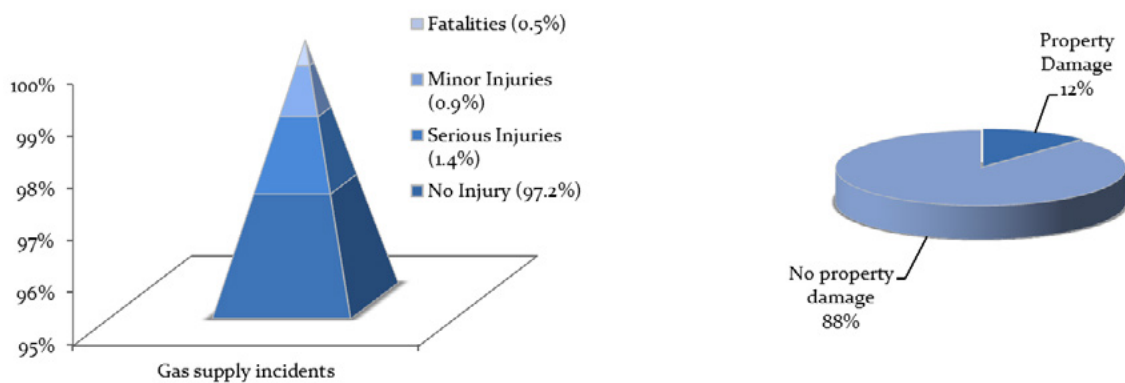


Figure 25 below is an indication of the injury types sustained in supply incidents. There were no fatalities recorded in gas supply incidents until 2012/13 when there was one fatality.

Of all gas supply incidents, 0.9% resulted in hospitalisation and 1.4% in minor injuries. The large majority of 97% of incidents have resulted in no injury. 12% of incidents resulted in damage to property.

**Figure 25: Gas Supply Incidents – Incidents resulting in fatality, injury, hospitalisation or property damage**





## CONCLUSION

The very nature of gas related incidents mean that they not only affect consumers but may also affect other members of the population as evident in incidents with multiple fatalities or injuries. On average one fatal gas incident has occurred every three years.

The type and distribution of gas varies among the States and Territories of Australia and New Zealand. A comparison of the FAFR with other jurisdictions indicates that WA has the fourth highest rate, and despite an increase in population, the number of fatalities has not increased.

Analysis of serious injuries shows an increasing trend in the number of incidents per million population. Most incidents resulting in serious injury involve water heaters and gas cookers. 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 appliances most commonly found in most incidents were gas hot water systems. LPG storage may also be an area of concern. Education on the safe use of gas and specific gas appliances may help to reduce the number and severity of utilisation incidents.

Analysis of gas supply incidents shows the inverse of utilisation with the majority occurring in a workplace environment. It is noted, however, that over half involved non gas related occupations. Although the majority of gas supply incidents were related to natural gas this is more reflective of the area of distribution piping and the size of the consumer base compared to LPG. Analysis of the number of incidents against consumer numbers indicates that LPG accounts for five times more incidents per thousand consumes when compared to NG.

Distribution piping damaged by third party contractors was at fault in most supply incidents. Concentrated efforts to improve the safety of distribution piping would positively impact the safety of gas supply.



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