



SGN
Your gas. Our network.

Driving awareness of CO; a data-driven strategy

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Executive summary

To achieve our goal of further reducing the number of UK CO incidents, it's vital we work collaboratively to deliver a CO strategy that is based on solid and relevant data, is practical, is sensitive to our customers, and ultimately prevents injury and saves lives.

The recent Gas Quality project we carried out in several remote towns in Scotland (examined in full detail within this report) has provided us with in-depth data.

The objectives of this report are to:

- Give an overview of current gas related CO statistics, initiatives and activities taking place across the industry.
- Set out the key historical facts about gas related CO incidents and awareness over the past few decades.
- Explore and share ideas about how to define a more effective CO strategy in collaboration with other gas distribution networks (GDNs) and stakeholders based upon our authoritative HSE endorsed Gas Quality project report.



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Using the conclusions drawn from the compelling data provided by our recent Gas Quality project, we've been able to take our CO strategy to a new level.



UK CO awareness overview

Annual UK CO associated activity (2015/16)

40

**Fatalities
associated
with CO**

200

**Suspected
CO
poisonings**

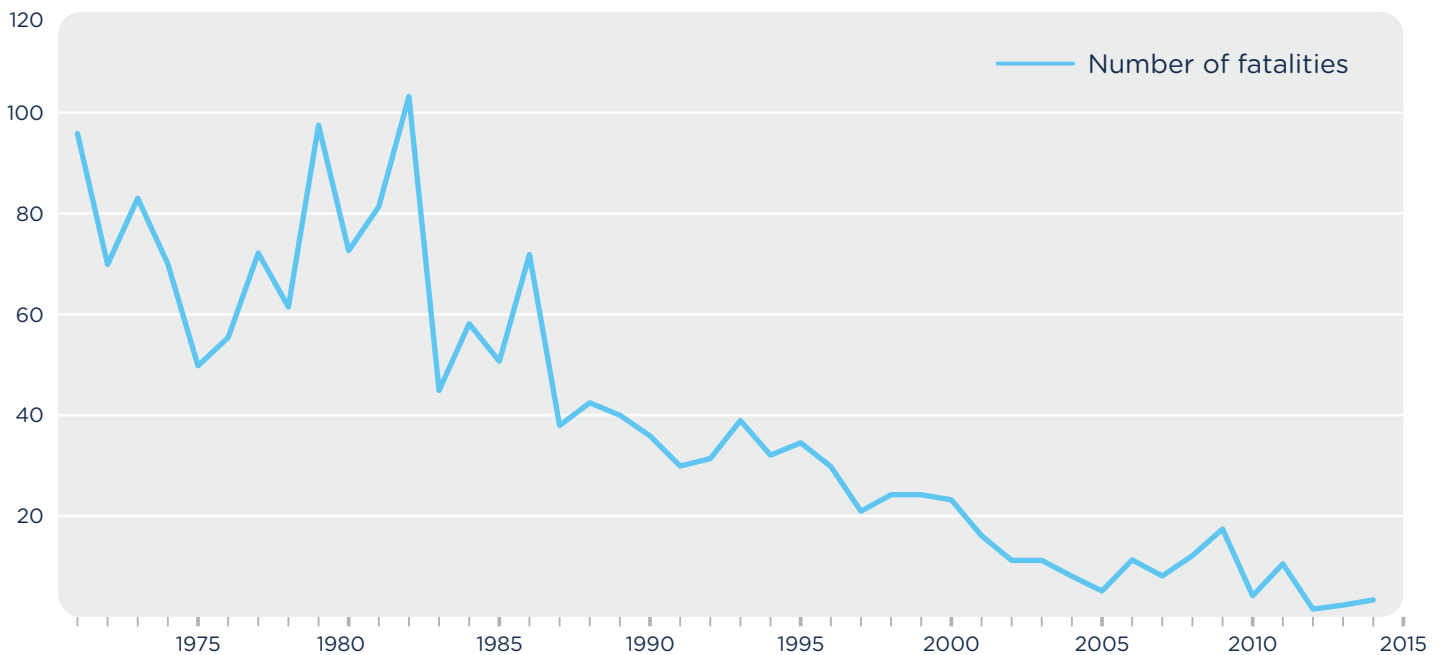
**20
incidents**

**four
fatalities**

These are the Department of Health's figures, recorded for all CO incidents across the range of fossil fuels (solid fuel, oil, portable bottled LPG, wood and natural gas) and a wide variety of equipment (eg boilers, fires, garage compressors, generators, barbecues and stoves). Other experts believe the real number is much higher as many fatalities are not diagnosed as CO poisoning.

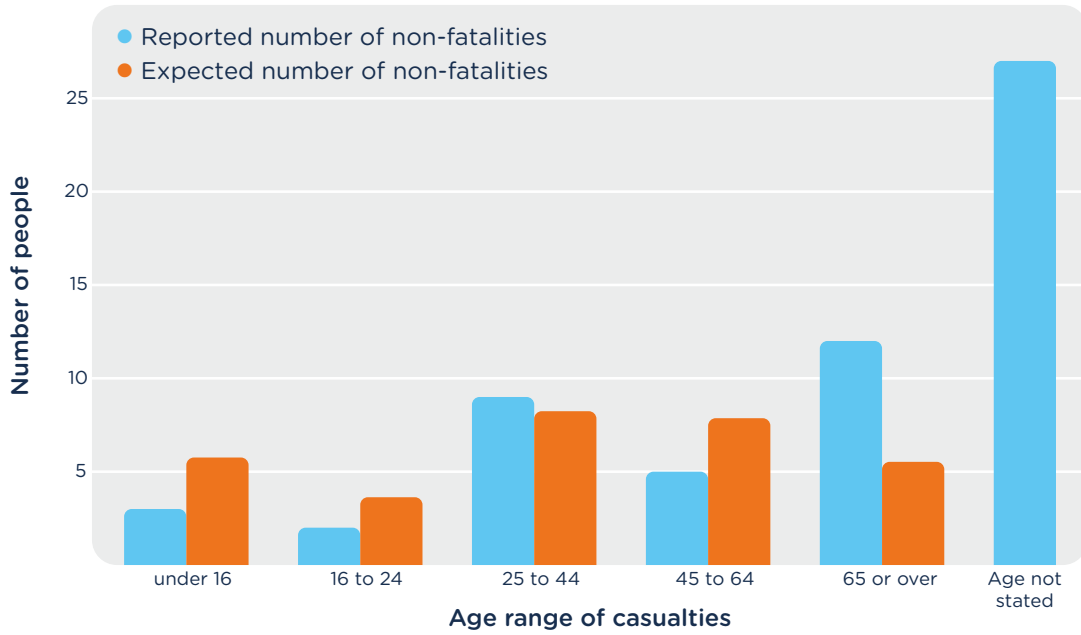
These are the most recent downstream incident data report (DIDR) statistics for gas only related incidents (published on behalf of the Gas Safety Trust).

UK natural gas carbon monoxide incident fatalities



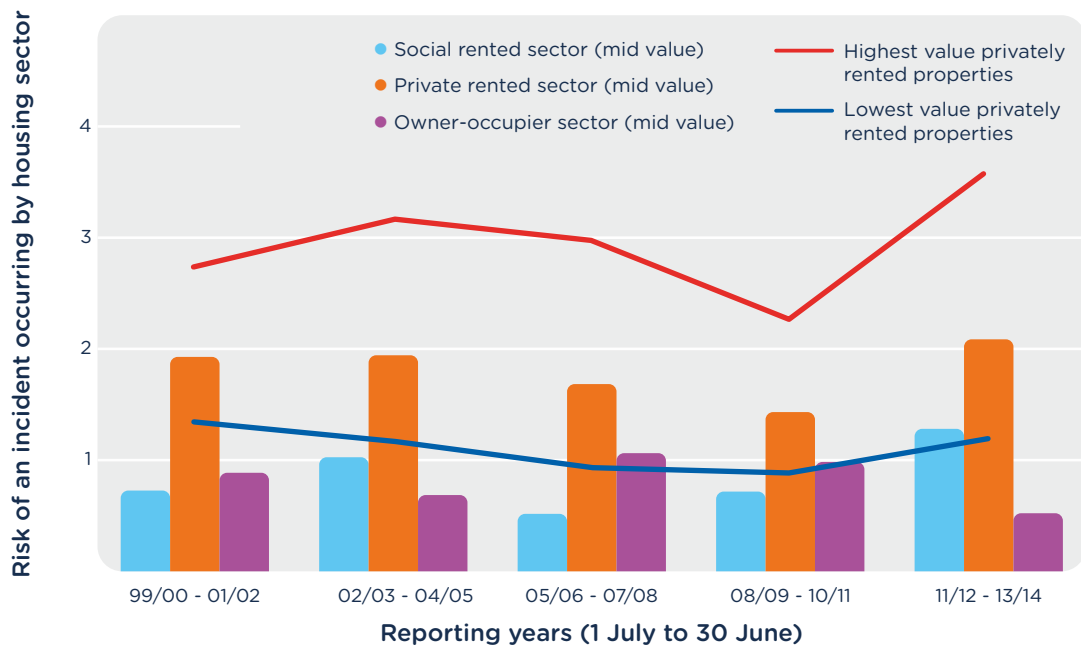
The number of fatalities reported annually has reduced since the incident database was established in 1996 from a peak in the late 1990s of 24 to an average of four per year over the years 2010/11 to 2013/14.

UK casualty age profile



It appears from the graph there are some differences between the age profiles of non-fatal casualties; most notably those over 65 appear to be more at risk. It's not possible to say whether the higher than expected numbers age 65 or over is significant as the numbers involved in the study are very low.

Historical risk of an incident by UK housing sector



This DIDR graph shows the risk associated with the private rented sector. It shows the risk has historically remained fairly constant at around twice that in any other housing sector.

The Downstream incident data report (DIDR) is produced by Downstream Gas for the Gas Safety Trust (formerly the CORGI Trust). Their high-level risk analysis identifies the main causes of CO incidents in the UK as:

- Lack of servicing and poor installation. DIDR's evaluation of CO incidents involving room sealed installations reveals flue related issues tend to be the predominant cause of failure. This indicates that, even for appliance types considered to be of relative safe design, regular flue maintenance is important.
- Defective flues / atmospheric conditions / ventilation deficiencies. DIDR reported a significant number of incidents involving space heaters (gas fires) were caused by debris, which then blocked the flue.
- Open flue appliances (76% of all incidents).
- Open flue central heating boilers (57% of all fatalities). The report tells us this type of boiler poses a risk of 7.3 times that of room sealed boilers.
- Installing appliances in compartments can exacerbate the rate at which CO is produced and spreads around a property following appliance/installation malfunction.
- Older properties, particularly those built in 1945 or before, generally have higher levels of background ventilation, which may help to reduce the chance of a dangerous build-up of CO.

Other key DIDR findings:

- Properties with double-glazing are not at an increased risk compared with those having single glazing.
- The type of floor construction is not considered to have a bearing on the likelihood of a CO incident occurring.



Factors acknowledged to have reduced CO incidents over the last 25 years

The current level of CO incidents clearly shows how the many safety initiatives implemented over the years have resulted in a significant reduction in the number of reported fatalities and injuries.

The following initiatives are all considered to have contributed to this downward trend in incidents linked to mains natural gas and piped LPG:

- The introduction of the flue gas analyser.
- The removal of open flue water heaters from bathrooms and bedrooms between 1986 and 1994.
- The 1993 Gas Appliance Directive (GAD).
- The Nationally Accredited Certification Scheme (ACS).
- Automatic appliance safety devices (eg domestic fire oxygen depletion sensors).
- Increased user awareness enhanced by the OFGEM supplier licence review.
- Landlord legislation.
- Boiler scrappage schemes.
- The requirement for new gas boilers to be condensing from April 2005.
- The use of CO alarms.
- The use of personal atmosphere monitors by gas distribution networks for CO detection.
- The focus of CO Charities, industry and government.
- Innovation and collaboration with all utilities, charities and government to raise CO awareness.

Data collection project

Introduction

We carried out a Gas Quality project during which we collected comprehensive data on the health of gas appliances during site visits within the discrete SIU (Scottish Independent Undertakings) network of Wick, Thurso, Oban and Campbeltown. The SIU Gas Quality project report provided much of the data, images and diagrams used within this document¹. The sample area was carefully selected to provide a statistical representation of the UK. Properties were chosen randomly by applying a unique number to each property and using an algorithm to select which ones would be subjected to a spot check. This made sure the results were representative of the general appliance population (i.e. a proportional spread of area, property type and both commercial/domestic appliance types).



During our 7,777 property site inspections we:

- Identified and recorded all types/makes of gas appliances and details of household members to evidence the data as being representative of the UK.
- Inspected and tested, or ‘no access risk assessed’² all gas appliances to demonstrate they were installed, serviced and operated correctly, and rectified them where necessary.
- Captured CO alarm data, and reported on the status of alarms in every property, installed a new alarm where one was not present.

Customer engagement

Incentives offered to customers for taking part included:

- Free repairs or a replacement appliance where the appliance was found to be faulty.
- Free installation of a CO alarm in every property tested.

Our four-week phased appointment system proved successful. Access was granted and the work completed at 3,139 (46%) of the total number of properties visited without needing specific day/timed appointments. The strategy also lessened the work load of our Customer Experience call centre and considerably reduced administration associated with planning appointments.

Initially, the total number of properties recorded as ‘access refused’ was 137 (1.7%) of all properties. ‘No-access’ cards were posted every week up to a maximum of four to re-engage with customers, after which we successfully gained access to properties we had missed. In some cases, landlords and letting agents assisted the project by allowing us to access vacated properties such as holiday homes. Following this additional customer engagement, the final number of access refused properties was reduced by 50% to 66 (0.8%).

Data management

Due to the significant amount of data involved and lessons learned from a previous project, an online dynamic data capture system (Xoserve8) was developed and implemented. Every property address was pre-loaded onto a database that engineers could access via tablet devices. The logical system ensured engineers followed a set procedure for testing, capturing, recording and uploading the information directly during an inspection.

This system allowed project performance to be monitored daily, producing management information that helped us manage workloads and resources. The compiled interim report data kept key stakeholders informed about the project and was useful in providing supplementary reports.

Testing methodology

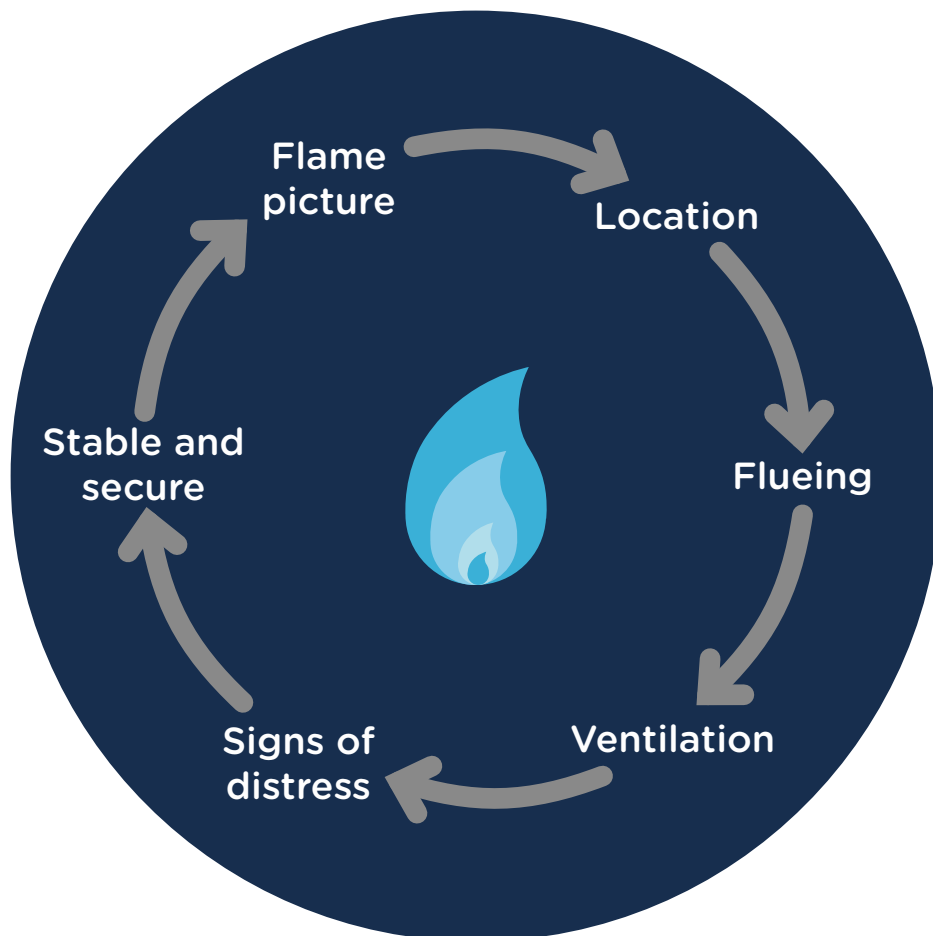
Information relating to appliance type, location and condition was captured at each property. A visual risk assessment was also carried out on every appliance in accordance with the Unsafe Situations Procedure.

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² We carried out qualitative and quantitative assessment of individual risk at ‘no access’ premises based on local information regarding appliances, current gas use (for properties with outside meter boxes), likely flueing, ventilation, service history and other relevant national and local data.

Unsafe situations visual risk assessment diagram



Testing took around 30 minutes but could vary depending on the number of appliances in the property. The procedures relevant to this CO report included:

- Gas soundness test of the installation.
- Inspection of the appliance and its installation in accordance with the Unsafe Situations procedure.
- Visual assessment of the flame with respect to flame stability, shape, length and colour.
- Visual assessment of the flue terminal and surrounding area where possible to look for evidence of broken/loose tiles, cement missing, signs of deterioration on chimneystacks and incorrect installations.
- A visual check for signs of soot formation, indicating a high risk that would require further action.
- A visual check to make sure ventilation grills were present when we suspected a conventional type boiler existed.
- A CO alarm survey to determine if an alarm was present, and it was correctly installed and functioning.

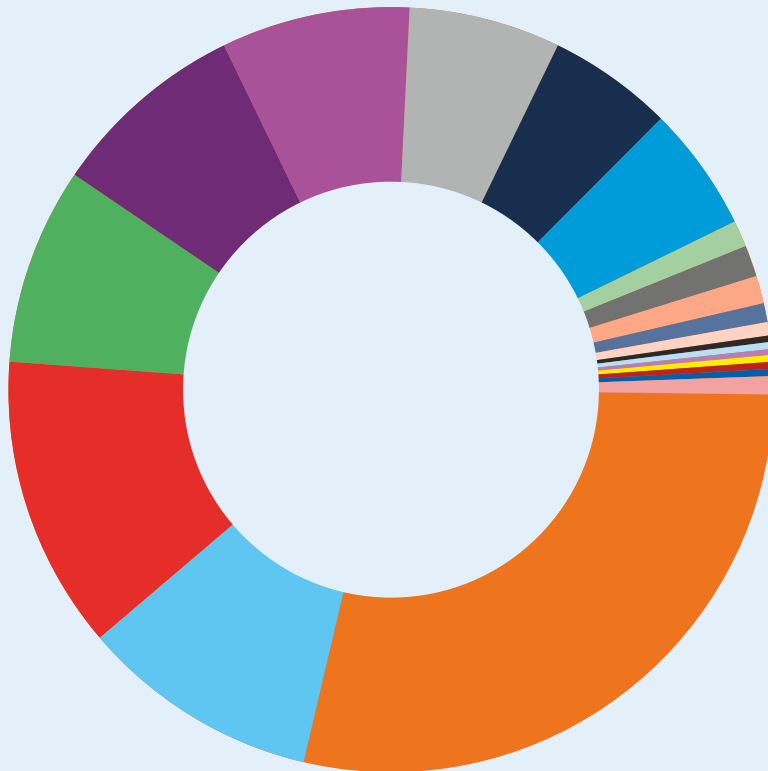
Typical appliance diversity/locations and flue type configurations



Appliance health

We grouped the inspected appliance data into appliance categories (central heating boilers, domestic cooking, space heating, commercial cooking, water heating, and other), and then sub-divided it by appliance type as shown overleaf.

Breakdown of appliance type



- Combination boiler: 3,092 (28.5%)
- Regular/system condensing: 1,076 (9.9%)
- Built in hob: 1,347 (12.4%)
- Cooker - slot in: 926 (8.5%)
- Back boiler unit: 885 (8.2%)
- Inset live fuel effect: 877 (8.1%)
- Regular/system non-condensing: 685 (6.3%)
- Decorative fuel effect fire: 574 (5.3%)
- Radiant: 568 (5.2%)
- Range: 144 (1.3%)
- Other: 133 (1.2%)
- Cooker - eye level grill: 115 (1.1%)
- Gas fire (LFE closure plate): 104 (1.0%)
- Hob: 50 (0.5%)
- Oven: 38 (0.4%)
- Built in oven: 32 (0.3%)
- Tumble drier: 32 (0.3%)
- Fryer: 25 (0.2%)
- Built in oven and grill: 25 (0.2%)
- Warm air heater: 22 (0.2%)
- Instantaneous water heater: 17 (0.2%)
- Storage water heater: 14 (0.1%)
- Other: 61 (0.6%)

Unsafe situation assessments were recorded against each appliance as:

- Satisfactory (S)
- At risk (AR)
- Concern for safety (CS)
- Immediately dangerous (ID)
- Not to current standards (NCS)

Any appliance that didn't pass the test performance criteria (i.e. those above the normal action limit, exhibiting high CO emissions, poor condition or incorrectly installed) were either repaired or replaced during the project free of charge. Where repair work was carried out (eg a service) the test was subsequently repeated and recorded.

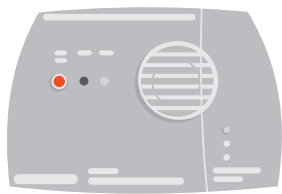
Appliance testing results and conclusions

- The overall access rate to the 7,777 properties was 86.9%, and of the 10,842 appliance inspections conducted, up to 97% were correctly installed, serviced and operated.
- Following inspection, a total of 206 appliances were replaced, the majority of which were over 20 years old.
- Using this report as a statistical representation of GB, it's estimated 4% of the GB population would currently be classified as 'at risk' against the Unsafe Situations Procedure.

Appliance maintenance, servicing and replacement on this project achieved a seven-fold reduction in absolute risk.

CO alarm installation and efficacy

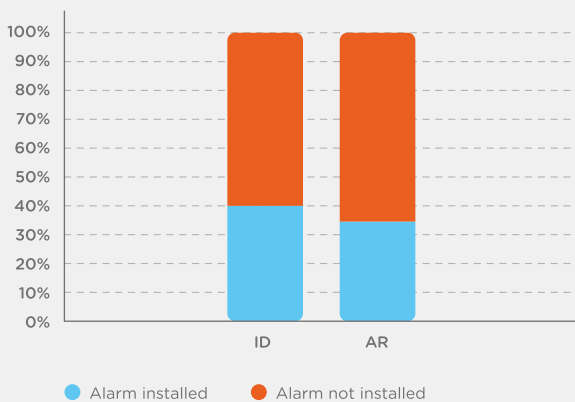
During site visits engineers gathered information on the presence and condition of existing CO alarms at the premises. The information gathered was based on appliances and not properties (i.e. was a CO alarm present in the same room as the appliance, and was it fitted correctly and functioning properly).



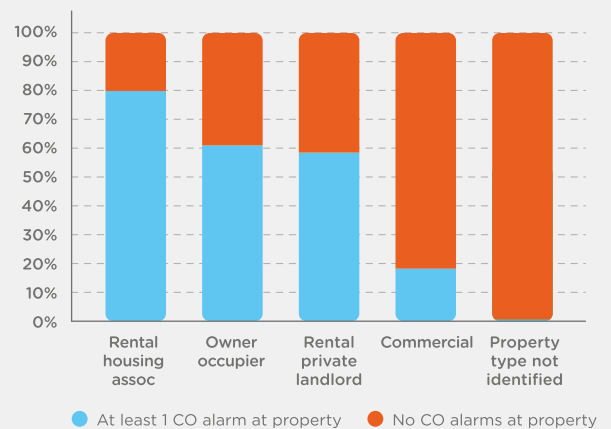
The survey revealed:

- 63% of all appliances were found to have an existing associated alarm, however 3% of these alarms were found to be either incorrectly positioned or not functional, while the remaining 37% of appliances had no associated CO alarm present.
- Around 60-65% of all of the AR/ID appliances reported were also found to have no associated alarm fitted.

Percentage of the unsafe appliances with/without a CO alarm installed



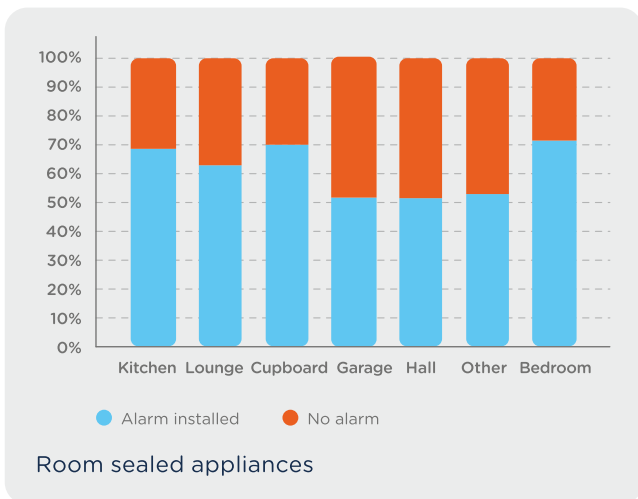
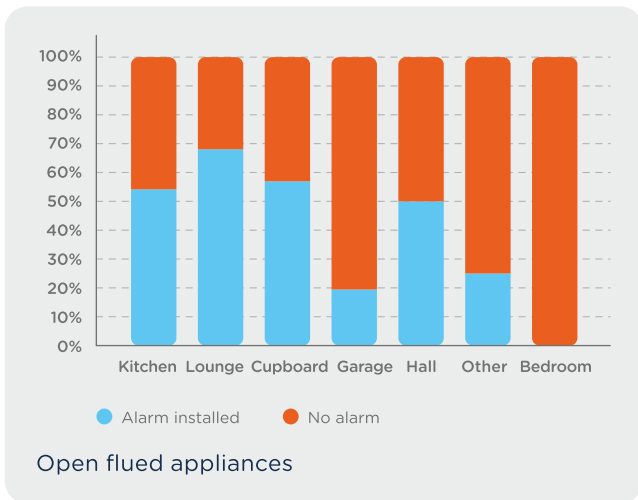
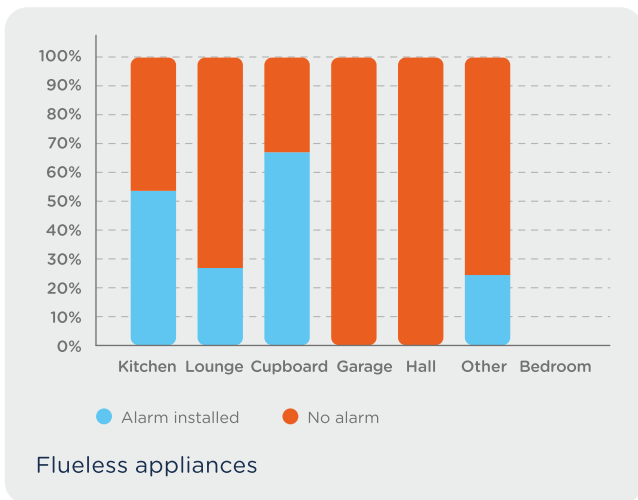
At least one alarm installed by property tenure type



- Housing associations are taking the lead on installation with up to 80% of their properties having CO alarms installed, while private letting/ownership trailed at around 60%.



Alarms installed by flue type



CO alarms installation and efficacy results and conclusions

- Based on evidence collated from the 6,759 properties and of the 10,842 gas appliances inspected:
 - 37% of appliances have no associated CO alarm.
 - 2.6% of CO alarms are installed in the wrong location.
 - 0.5% were inoperable.
- Around 60-65% of all of the at risk (AR) or immediately dangerous (ID) appliances reported were found to have no associated alarm fitted, which may suggest users who don't regularly inspect/maintain their appliances are also less likely to install a CO alarm.
- Analysis showed there are large numbers of CO alarms fitted in cupboards despite installation instructions recommending these locations be avoided.
- On a more positive note, sitting rooms had a high percentage of alarms installed (i.e. where one would expect most open-flue appliances to be installed).
- Although campaigns recommend all gas appliances require a CO alarm irrespective of flue type, attention to the riskier (flue less/open flue) appliances should perhaps be clearer (but without creating confusion with too much technical guidance).

Conclusion

Appliance maintenance, servicing and replacement on this project achieved a seven-fold reduction in absolute risk.

This compelling statistic underpins our recommendation that GDN CO awareness strategy must focus on these protective measures.

Anecdotal feedback from customers indicated they were inclined to think the installation of a CO alarm meant there was no longer need for regular appliance inspection and maintenance. Communication and campaigning regarding CO should be clear that having a CO alarm is no substitute for regular maintenance and servicing.

What's next?

Our goal is to further reduce the number of CO fatalities and injuries whatever the source by:

- Pro-actively promoting preventative and protective measures at every opportunity.
- Continuously reviewing and improving CO awareness strategy, and embedding CO awareness initiatives proactively within our industry and the country as a whole.
- Offering tangible, practical support by providing emergency and safety interventions to prevent serious harm and death from CO poisoning, gas leaks and fires (eg the online CO awareness survey of students we commissioned which is informing our Human Factors based prevention strategies, and the free locking cooker valve service).
- Driving industry dialogue in collaboration with other GDNs, and sharing best practice.
- Supporting changes to UK and European law.

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Issue: Making customers aware that different types of appliance can create different levels of risk.

It is perhaps surprising appliances have not yet been sorted into risk categories as some require more frequent attention than others. For example:

Back boilers and open flue appliances (e.g. free standing wall mounted open flue boilers as most of these are now more than 20 years old) should be serviced every year. These appliances get clogged up with lint (fine fibres/particles) regularly as they take in air and therefore dust from inside the property at which point they produce more CO. Heavy linting also causes a significant drop in appliance efficiency leading to increased annual gas consumption.

DIDR 2013/14 tells us the number of incidents reported involving boilers with open flues has been disproportionate to the number of installations nationwide, and their investigation has highlighted the importance of regular servicing for this particular appliance type. Boilers with open flues posed a risk of 7.3 times that of room sealed boilers.

Room sealed/fan flue appliances that don't depend on air and ventilation from inside the property (their air intake is from outside) carry less risk. If a room-sealed appliance has a completely blocked flue it won't operate, unlike open flue appliances that continue to work and fill a room with harmful combustion by products.

Solution: We'll provide concise, illustrated advice to customers so they can visually check the areas around their gas appliances for signs of malfunction. Customers may be reluctant to sign up to regular maintenance but providing images could help them with a visual assessment that prompts them to book a service.

For example:

- It only takes a peek under the fire when a back boiler is working to see if it needs a service.
- A yellow floppy flame/heavy soot on the ceramics within older gas fires means it needs immediate attention (although to avoid confusion, it should be noted that new fires are now designed to produce yellow flames).
- The grill frets in high level grills should be checked for holes or warping, and that the flame burns evenly and blue.



We've shared all our data (anonymised for data protection purposes) with appliance manufacturers through the Heating and Hotwater Industry Council and the Industrial and Commercial Energy Association. We now need to encourage them to take this valuable information and our conclusions into account when creating their own product communications for customers.

We'll encourage Government to undertake another national boiler scrappage/replacement scheme focusing not only on age but also boiler type, so riskier open flue boilers can be exchanged for more efficient and safer category A condensing ones, directing scheme spend more effectively.

Many housing associations still have plenty of open flue appliances installed, so this could be a good starting point for the introduction of a compulsory replacement programme.

Issue: Targeting specific demographics

The old - Statistics show that elderly and people living in vulnerable circumstances are at a much greater risk from gas leaks and fires in their homes, especially if they are:

- Suffering from types of dementia/ cognitive impairment.
- People with learning disabilities.
- People who suffer from blindness, deafness, and sensory impairment for smell.
- People with poor mobility, Parkinson's disease, arthritic conditions.
- People who have recurrent falls and accidents or a history of burns/gas-related incidents.

Greater focus is needed on targeting this group that is often financially reluctant or unable to pay for servicing, or ignorant of the inherent dangers associated with badly maintained appliances. We're working with NEA and Fire and Rescue services to carry out a trial to understand more about the additional support these people may need.

The young - CO awareness campaigns in schools using initiatives such as the annual GDNs' CO safety competition, together with financial and practical support of interactive safety centres has been very effective in educating young children. Promoting landlords' legal responsibilities to students and CO alarms through university freshers' events is helping to protect young adults, but not every UK university is part of this programme. Nor are young adults who are moving into their own home for the first time.

We've helped and advised on CO storylines for several peak time TV soaps such as Coronation Street, EastEnders, Hollyoaks and Emmerdale. The CO storylines usually run for several months over the winter which helps raise awareness at this key time of year. We've also taken part in ITV's Loose Women programme to highlight the dangers of using BBQs in confined spaces such as caravans, tents and kitchens.



Solution: We will:

- Expand the messaging through our partnership with the Royal Voluntary Service (RVS) to include stronger advice about appliance servicing. Specific information could be included in the 'Winter Wellness' leaflet we sponsor, by employees attending RVS events, and by educating RVS volunteers to identify dangers and ask their members the right questions.
- Expand the messaging through our partnership with Girlguiding UK.
- Extend education of front line support workers including energy advisors and social workers.
- Progress the concept of developing NVQ sanctioned 'Gas safety in the home' training to give front line care workers real life reference points and examples to work with in order to broaden their knowledge through shared experience, and offer them tangible support by providing checklists and procedures to follow in most case scenarios.



Issue: Mechanisms need to be put in place to encourage older people to service their appliances regularly.

It's often the grown up children of elderly customers who encourage their parents to service appliances or arrange it for them, but not everyone has this type of support. They might also be fearful of having their supply cut off, leaving them without the ability to cook or heat their home if an appliance is found to be faulty.

Solution: We'll target family/carer groups with emotive campaigns delivered through social media and trusted partners such as the RVS, Girlguiding UK and Fire and Rescue with the message 'This could be your mum/dad/aunt/uncle.'

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Issue: CO alarms fitted in cupboards.

Some customers mistakenly think an alarm should be fitted as close to the appliance as possible.

Solution: We'll re-educate customers about where an alarm should be installed using clear, visual examples. Through our trusted partners such as Fire and Rescue we'll continue to check CO alarm locations, and provide advice where necessary.

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Issue: Classification of CO detection

The majority of our CO related callouts (approximately 14,000 last year) are actually CO alarm battery failures. Engineers often don't distinguish between a real CO reading and a suspected incident as they are given this selection option even if there is no evidence of CO. This reporting skews the overall CO data.

Solution: We'll only report on verified CO related findings.

Contact us

If you'd like to be part of the conversation to ensure your views count or if you have any questions on our carbon monoxide activities please get in touch.



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