

Gas Information Sheet No. 44

Carbon monoxide safe working level

Introduction

To assist gasfitters in carrying out **carbon monoxide (CO) spillage testing** this information sheet will:

- provide background information for CO exposure
- make sure gasfitters are safe from undue CO exposure
- explain the need to keep exposure to CO under check
- help determine CO exposure after a spillage test, and accumulated exposure over an 8 hour day.

Understanding exposure levels

According to Safe Work Australia the maximum recommended exposure to carbon monoxide (CO) gas measured over an eight hour period is **30 ppm** (parts per million) based upon a Workplace Exposure Standard.

Safe Work Australia explains an eight-hour time-weighted average (TWA) exposure standard is the average airborne concentration of a particular substance permitted over an 8-hour working day and a 5-day working week.

At times gasfitters may be subjected to higher concentrations of CO gas for short durations, for example at appliance flues or at draught diverters. To guard against prolonged exposure to high concentrations of CO the following table, from Safe Work Australia, provides guidelines for the control of short term excursions above the 8 hour TWA exposure standard.

Guidelines for the control of short term excursions for carbon monoxide

Concentration ^(a) (ppm)	Total exposure ^(b) (min.)
200	15
100	30
60	60

(a) Short term excursions should never exceed 400 ppm.

(b) This duration represents the sum of exposures at this level over an 8 hour workday, and assumes no other exposure to carbon monoxide.

For further information on workplace exposure standards for airborne contaminants (i.e carbon monoxide) go to the following links.

<http://www.safeworkaustralia.gov.au/sites/SWA/about/Publications/Documents/772/Workplace-exposure-standards-airborne-contaminants.pdf>

<http://www.safeworkaustralia.gov.au/sites/SWA/about/Publications/Documents/771/Guidance-interpretation-workplace-exposure-standards.pdf>

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Measuring your exposure

It is unlikely gasfitters will be exposed to CO on every job they attend, however where CO is encountered exposure levels will most likely be low as the CO concentration in the room will be far less than the concentration at the appliance while the spillage test is underway.

Gasfitters should use a calibrated gas analyser or carbon monoxide detector (refer to ESV Gas Information Sheet 37) to check ambient CO levels while conducting spillage tests.

To measure your exposure to CO gas over an eight hour period you need to measure the amount of CO where you are located, not the CO readings only at the appliance.

Begin your spillage testing:

1. Test for CO spillage as outlined in Gas Information Sheet 38 for:
 - Open flued indoor gas appliances – fabricated flue
 - Open flued indoor gas appliances – existing chimney
 - Central heating units
 - Room sealed space heaters
2. While carrying out CO spillage testing (above) take readings of CO gas concentration in the room in which you are working and note the time of your exposure (i.e. the length of time of your spillage test).

You need this information to calculate your time weighted average CO exposure level for an eight hour period. This becomes very important when planning to carry out a number of spillage tests in one day so that you can anticipate when you are approaching the maximum allowable limit of 30 ppm of CO.

If you are exposed to higher CO concentrations near the appliance, while carrying out spillage testing, also include this exposure and duration of exposure in your time weighted average calculations.

Exposure over an eight hour period can be calculated with the following formula.

$$TWA_{8 \text{ hour}} = [\text{Exposure time (min)} \times \text{CO (ppm)}] / 480 \quad (\text{8 hours is equivalent to 480 minutes}).$$

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Exposure calculations

These examples are only for demonstration and may not reflect actual CO occupational exposure levels.

Note: CO concentration when not in a testing environment is assumed to be negligible, i.e. 0 ppm.

Example 1

A gasfitter attends a job to test for CO spillage believed to be coming from a gas heater in a domestic dwelling. The whole test takes 20 minutes, and even though the measured CO spillage from the gas heater draft diverter was 400 ppm, the gasfitter was only exposed to 90 ppm CO (ambient exposure) for the 20 minutes of the test.

Exposure concentration while testing: 90 ppm
Exposure time while testing: 20 minutes

Exposure calculation: Time weighted average exposure calculation

$$= (90 \times 20)/480 = 2400/480$$

$$= 3.75 \text{ ppm exposure over eight hours.}$$

An average exposure of 3.75 ppm CO gas over eight hours is well below the maximum recommended exposure limit of 30 ppm.

Example 2

A gasfitter attends six separate jobs to test for CO spillage from gas heaters in six different domestic dwellings. Test times vary from 15 to 35 minutes. While the measured CO spillage from each of these appliances is 400 ppm, the gasfitter was exposed to varying levels of CO during the tests. See the example below for an explanation.

Number of test jobs: 6 separate jobs
Exposure time while testing: variable
Exposure (ambient) concentration while testing: 90 ppm for 30 minutes – for job 1
85 ppm for 35 minutes – for job 2
100 ppm for 25 minutes – for job 3
180 ppm for 15 minutes – for job 4
110 ppm for 27 minutes – for job 5
45 ppm for 32 minutes – for job 6

Exposure calculation: Time weighted average exposure calculation

$$= [(90 \times 30) + (85 \times 35) + (100 \times 25) + (180 \times 15) + (110 \times 27) + (45 \times 32)]/480$$

$$= [2700 + 2975 + 2500 + 2700 + 2970 + 1440]/480$$

$$= 31.8 \text{ ppm exposure over eight hours.}$$

Exceeding 30 ppm of CO gas exposure over eight hours is not recommended.

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Example 3

If you measure your level of exposure to CO gas over time (i.e. at the end of each job collectively) you will clearly see at which job you should have considered stopping any further spillage testing. Using the figures from Example 2 the collective exposure to CO gas, as each job is completed, is shown in the table below.

Job	Collective exposure to CO (ppm over 8 hours)
1.	5.6 ppm exposure after the first job is completed.
2.	11.8 ppm collective exposure, after the first and second jobs have been completed.
3.	17.0 ppm collective exposure, after the first three jobs have been completed.
4.	22.7 ppm collective exposure, after the forth job was completed.
5.	28.8 ppm collective exposure, after fifth job was completed. At the end of this job you may consider stopping any further testing as your CO exposure level is reaching the limit of recommended exposure.
6.	31.8 ppm collective exposure. <i>The recommended exposure limit has been exceeded.</i>

Conclusion

Monitoring your CO levels over an eight hour period is important to your health and well being, and even though you are unlikely to experience CO at every job, it is always safest to keep an eye on your exposure.

For further information, contact the Gas Technical Information Helpline on 1800 625 563.