

Welding fume: Frequently encountered – not to be underestimated

Welding fume facts

- Fume is a complex mixture of metallic oxides, silicates and fluorides.
- It is created when a metal is heated above its boiling point and the vapours condense into very fine particles.
- It usually contains particles emanating from both the material being welded and the electrode.
- A 2019 study found that welders present, on average, a 43% increased risk of lung cancer.¹
- Drinking milk before welding doesn't protect you from the effects of breathing in welding fume!

¹ 2019 Honaryar MK, Lunn RM, Luce D, et al. *Occup Environ Med*



Welding is used in many industries. Some welders are skilled professionals who spend most of their working days doing nothing but welding; others are non-specialists for whom welding may be only an occasional task. All of them, though, need to be aware of the risks that go with welding. These are not just the obvious hazards associated with welding work, such as very high temperatures and electricity, but also the harmful effects of breathing in fume produced during welding.

Although welders themselves are the people whose health is threatened by welding fume, their employers too may suffer if they fail to take the appropriate steps to protect their workers. Workers exposed to welding fume can result in lower productivity, not least because their ill health may result in increased absence. And of course, employers shown to be negligent can be – and have been – made to pay in court.

Harmful constituents of welding fume and gases:

- Aluminum
- Beryllium
- Cadmium Oxides
- Carbon Monoxide
- Chromium
- Copper
- Fluorides
- Hexavalent Chromium
- Hydrogen Fluoride
- Iron Oxides
- Lead
- Manganese
- Molybdenum
- Nickel
- Nitrogen Oxide
- Ozone
- Vanadium
- Zinc Oxides

The health risks from welding fume

The UK's Health and Safety Executive has identified several health risks associated with welding fume. These include:

- Lung infections that can lead to severe and sometimes fatal pneumonia
- Occupational asthma – stainless steel fume contains chromium oxide (CrO₃) and nickel oxide, both of which can cause asthma
- Cancer – welding fume is internationally classified as possibly carcinogenic to humans
- Metal fume fever – consists of flu-like symptoms, and is usually linked to welding or hot work on galvanised metals
- Irritation of the throat and lungs – gases and fine particles in welding fume can cause dryness of the throat, tickling, coughing or a tight chest
- Temporary reduced lung function – overall lung capacity and efficiency are affected by prolonged exposure to welding fume

Employer responsibilities

The person conducting a business or undertaking (PCBU) has the primary duty of care. A PCBU must eliminate risks arising from welding processes, or if that is not reasonably practicable, minimise the risks so far as is reasonably practicable. The responsibilities outlined in Weld Australia guidance include:

- Developing and subsequently maintaining a register of all hazardous chemicals used or produced in the workplace.
- Maintaining a collection of SDS as part of the register. This register must be available for reference by all employees.
- Ensuring a suitable and sufficient assessment is made of the risk to health created by welding fume or other hazardous substances.
- Revising the assessment at least every 5 years or if workplace conditions change significantly.
- Providing training to all employees with the potential for exposure to welding fume.
- Keep records of training and assessment – assessment reports must be available to employees to whom the assessments relate.
- Providing health monitoring for employees assessed as being exposed to a significant health risk at work.
- Undertaking monitoring where the need is indicated in the assessment.

The material being welded determines the composition of fume

- Fluxes containing silica or fluoride produce silica, metallic silicates and fluoride fumes
- Fume from mild steel welding contains mostly iron with small amounts of additive metals (chromium, nickel, manganese, molybdenum, vanadium, titanium, cobalt, copper, etc.)
- Stainless steels generate larger amounts of chromium or nickel in the fume and smaller amounts of iron
- Nickel alloys produce much more nickel in the fume and very little iron

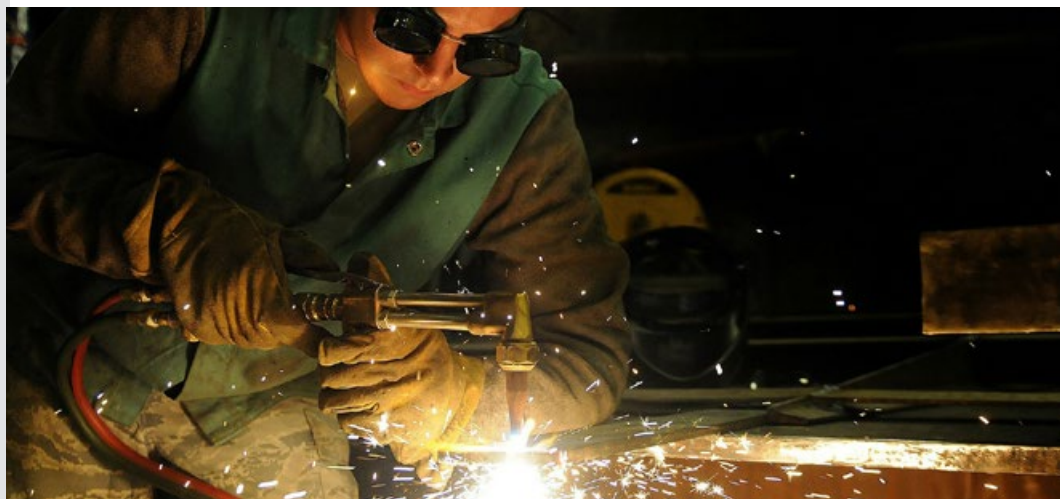
- Ensuring that exposure of employees to hazardous chemicals is prevented or adequately controlled to minimise risk to health. Exposure must not exceed the relevant exposure standards.
- Ensure that engineering controls and safe work practices are effectively maintained.

Managing the risk from welding fume

There will obviously be less risk from welding fume if another method of joining or cutting metal can be used, such as bolts, rivets or using metal parts prefabricated in such a way as to minimise the number of welds required. However, in many instances welding is the best or only option available. There are many factors which affect the risk to the welder and which need to be controlled.



Welders working indoors or in confined spaces are more at risk than those working in the open air, as are those crouching over their work as opposed to welding from a standing or sitting position. Wherever possible, a welding job should be set up in such a way that fume is not travelling straight into the welder's face. The appropriate RPE (Respiratory Protective Equipment) should be worn. In many instances, though, protection can only be ensured by using effective extraction equipment.



Different welding techniques create varying degrees of risk:

Least risk

- Submerged arc
- Resistance welding
- Laser cutting
- TIG
- Plasma cutting
- MIG
- Flame cutting
- MAG
- MMA
- Flux core
- Arc gouging
- Highest risk

Further information

Safe Work Australia

[https://](https://www.safeworkaustralia.gov.au/doc/welding-fumes-and-gases)

[www.safeworkaustralia.gov.au](https://www.safeworkaustralia.gov.au/doc/welding-fumes-and-gases)

[/doc/welding-fumes-and-](https://www.safeworkaustralia.gov.au/doc/welding-fumes-and-gases)

[gases](https://www.safeworkaustralia.gov.au/doc/welding-fumes-and-gases)

The Cancer Council

<https://www.cancer.org.au/cancer-information/causes-and-prevention/workplace-cancer/welding>

Weld Australia

<https://weldaustralia.com.au/>

RVT's free site assessments quickly identify what fume control measures are appropriate for every individual situation.

The benefits of fume extraction

Using the right equipment in the right set-up ensures that fume is captured at source and safely extracted. Creating negative pressure further prevents the dissipation of fume and directs it to the capture point. Where fume is particularly toxic, the capture point can be located outside.



The UK's HSE has identified the following instances where extraction would normally be needed:

- Moderate to high volume MIG/MAG production welding, small or medium sized parts, welding on a bench or in a screened off area, and welding on carbon (mild) steels and aluminium
- High volume production welding using TIG on stainless steels or aluminium
- Welding of stainless steels using MIG, MAG, Flux cored or MMA (stick welding)
- Arc air gouging
- Welding or hot cutting galvanised materials (zinc plated)
- Welding or hot cutting materials containing cadmium, or painted with lead or chromate paints
- Automated cutting (eg flame or plasma – many cutting machines already have extraction systems built in to the cutting table)
- Automated multi-head resistance welding machines