Working with welding fumes

What are welding fumes?

Welding is a process that permanently joins (fuses) materials together, usually metals, by heat. Welding fumes are a by-product of welding and are produced when a metal is heated above its boiling point and its vapours condense into very fine particles. Due to their size, these particles can easily be breathed into the lungs. Welding fumes can be seen when concentrated, but individual fume particles are too small to be seen by the naked eye and remain airborne long after the welding process has stopped. The type of materials that are commonly welded, soldered or treated in a manner that produces fumes typically contain metals such as aluminium, chromium, copper, iron, lead, and manganese. Breathing in welding fumes can be hazardous to your lung health, causing lung disease and cancer.

In addition to welding fumes, breathing in the gases and vapours produced such as ozone can also be hazardous to the lungs.

Other welding hazards

There are other health hazards that result from welding, such as:

- Radiation
- Heat/Fire
- Electricity
- Noise

Who is at risk of welding fumes exposure?

If you are near or involved in welding processes, you are at risk of exposure to welding fumes. Some activities and tasks may increase your likelihood of exposure to welding fumes, such as the frequency of welding tasks, the type of welding materials and processes being used, where the welding is occurring and the control measures being used by the welder.

Welding can occur in many industries, such as:

- Construction
- Manufacturing
- Mining
- Automotive
- Aerospace
- Shipping
- Rail
- Agriculture
- Arts
- Boiler making
- Other trades

How are welding fumes hazardous to your health?

Due to their small size, welding fumes can remain airborne for long periods of time and become easily inhaled into the lungs. This can cause a range of short and long-term health effects. The risk of developing an adverse health effect from exposure to welding fumes is dependent on the exposure dose, which is the amount of welding fume generated multiplied by the amount of times a person is exposed. Welding fumes are classified as a Group One carcinogen, meaning they can cause cancer in humans, including lung cancer.[1]

Short term (acute) respiratory health effects can occur soon after exposure to welding fumes and may include symptoms such as:

- Irritated throat and airways
- Worsening of Chronic Obstructive Pulmonary Disease (COPD) symptoms
- Metal fume fever, which typically presents with flu like symptoms
- Pneumonia.

Long term (chronic) respiratory health effects generally develop after ongoing exposure to welding fumes and may include:

- Lung cancer
- COPD
- Occupational asthma
- Work-exacerbated asthma – worsening of already existing asthma symptoms
- Pneumoconiosis or pneumosiderosis.

Exposure to welding fumes and other welding hazards may also cause non-respiratory related health effects or illness. Welding in a confined space may also lead to asphyxiation which can be fatal.

How can you manage or reduce your exposure to welding fumes?

All employers have a legal obligation to manage the risks to workers' health and safety. Obligations may differ slightly between states and territories; however, your employer's duty to ensure you can work without risk to your health remains.

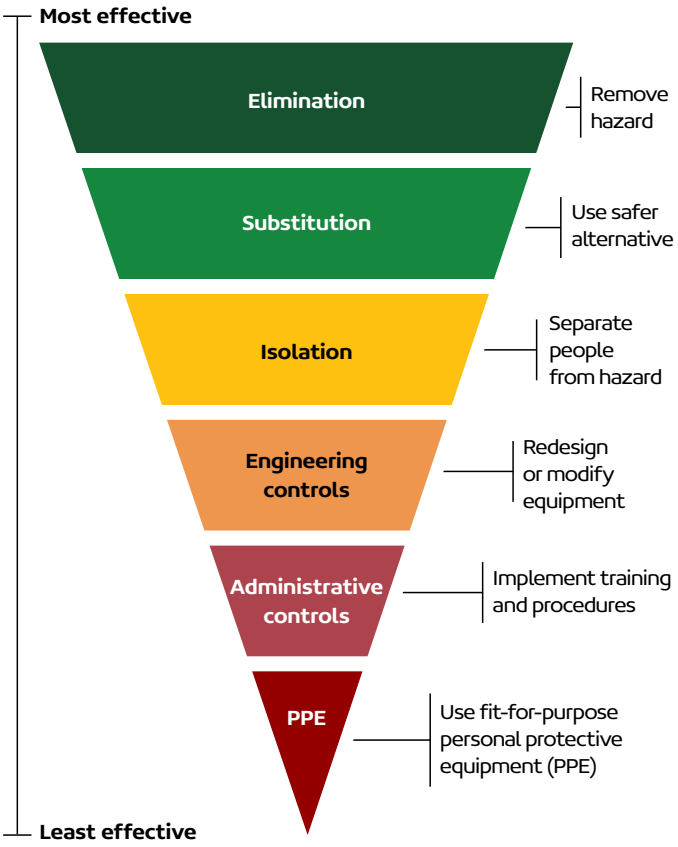
Hierarchy of Controls

The most effective way to reduce your exposure to welding fumes is by following the Hierarchy of Controls, which organises control measures from the highest level of effectiveness (Elimination) to the lowest level (Personal Protective Equipment). Below are some examples of control measures that may be used to reduce exposure to welding fumes. While your employer is responsible for implementing control measures, they must consult with workers about implementing controls to manage health and safety risks in the workplace.

Control	Examples
Elimination: Not using processes that generate welding fumes	Eliminate the need for welding activities. For example: • Design the job so there is less hot work • Purchase raw materials with edge profiles already cut.
Substitution: Using alternative processes, machines or materials	Substitute welding processes with safer alternatives. For example: • Use welding techniques that produce less fumes or the fumes may be less toxic (e.g., by removing surface coatings prior to welding) • Use lowest current/voltage applicable for arc welding • Optimise shielding gas • Automate welding activities where possible.
Isolation: Isolating workers from the welding fumes	Separate welding activities and fumes from other workers or jobs. For example: • Use welding screens to protect other workers from welding arc.
Engineering Controls: Redesigning or modifying equipment and processes	Use suitable local exhaust or forced dilution ventilation to remove fumes at their source. For example: • Use jigs or mechanical aids to enable welding in position where fumes rise away from the face • Ensure adequate room ventilation • Conduct regular air monitoring.
Administrative Controls: Implementing training and procedures	Using processes or systems which will help reduce the generation of welding fumes or workers' exposure to welding fumes. For example, introduce training and policies around: • Introducing dedicated areas for welding • Controlling access to working areas • Using warning signs when welding is occurring • Minimising work carried out in enclosed or confined spaces • Implementing a maintenance and test regime for ventilation systems • Sharing and rotating job tasks involving welding between workers • Reducing the number of workers exposed and the period of exposure to welding fumes • Ensuring any staff working adjacent to welding activities are not exposed • Information, training, instruction and supervision must be provided to workers on health hazards associated with welding fumes and use of control measures (including respiratory protection).
Personal Protective Equipment (PPE): Using fit-for-purpose PPE	PPE is the **lowest form of protection** on the Hierarchy of Controls and should not be relied on or used solely to protect against welding fumes. Exposure to welding fumes is best controlled at the source. For example: • PPE must be worn by workers when welding – they should wear air supplied or air purifying respiratory protection and a full-face welding helmet with a UV filtered lens • Respiratory protective equipment (RPE) must be fit tested for all workers • Workers should be clean shaven to ensure a proper fit and seal of RPE • Maintain all PPE according to the manufacturer's instructions.

Note: Some of these measures might not be practical in all workplaces.

Hierarchy of Controls pyramid



What else can you do to protect yourself?

- Quit smoking and/or vaping to further protect your lung health
- Report your workplace exposure to your doctor, even if you are not experiencing symptoms. When your doctor is aware of your exposure, they can better monitor your lung health and overall wellbeing
- Speak to your employer about your workplace exposures and any health monitoring programs available that you and your coworkers should be participating in
- Follow all reasonable instructions given and work in compliance with any training that you have undertaken
- Make sure you understand how to implement workplace exposure controls and verify that they are effective with your employer or health and safety representative
- Use the appropriate PPE consistently and in accordance with the manufacturer's instructions.

Workplace Exposure Standard

Under legislation, a person conducting a business or undertaking (PCBU) must ensure that no person in the workplace is exposed to hazardous agents at a level exceeding the Workplace Exposure Standard (WES). The current Australian WES for welding fumes is 1mg/m^3 time-weighted average over eight hours.[2]

FURTHER INFORMATION

For more information on welding fumes, relevant to your state or territory, visit our **Occupational Lung Disease National Directory**.

Find out more about welding fumes and ways to protect yourself at:

- Lung Foundation Australia - **lungfoundation.com.au**
- Safe Work Australia - **safeworkaustralia.gov.au**
- Australian Institute of Occupational Hygienists - **aioh.org.au**
- Breathe Freely - **breathefreelyaustralia.org.au**
- Your local state/territory workplace health and safety regulation body.

Lungfoundation.com.au | Freecall 1800 654 301 | enquiries@lungfoundation.com.au

References:

1 https://monographs.iarc.who.int/list-of-classifications
2 https://www.safeworkaustralia.gov.au/doc/workplace-exposure-standards-airborne-contaminants-2024

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