



HAZARD ALERT

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ELECTRIC WELDING (FUMES AND VAPOURS)

From 18 January 2024, the workplace exposure standard (WES) for welding fumes will be reduced from a time-weighted average (TWA) airborne contamination of 5mg/m³ over an eight-hour period to a TWA of 1 mg/m³ over an eight-hour period.

In March 2017, the International Agency for Research on Cancer (IARC) re-classified welding fumes from a Group 2B carcinogen (possibly carcinogenic to humans) to a Group 1 carcinogen (carcinogenic to humans).

The four main arc welding processes (in decreasing order of fume generation) are as follows:

Flux Cored Arc Welding (FCAW)

- This process uses a continuous feed filler metal with a hollow core filled with flux that generates a shielding gas and slag to protect the weld. An external supply of shielding gas from a gas cylinder may also be required where some FCAW consumables generate minimal shielding. Self-shielded FCAW, in particular, can generate very high levels of fume.

• Manual Metal Arc Welding (MMAW)

This process is also known as Shielded Metal Arc Welding (SMAW), stick welding, manual welding or manual metal arc welding. The electrode is a consumable metal coated with a flux, which as it breaks down generates carbon dioxide (CO₂), and in some cases fluorides, that shields the weld (i.e. reduces oxidation of the metal) and forms a slag.

• Gas Metal Arc Welding (GMAW)

This process uses a spool of continuously fed solid wire electrode (bare metal or copper coated wire) and an external supply of shielding gas (e.g. Argon & CO₂). It is widely used in industry and commonly referred to as MIG (metal inert gas) welding. The dip transfer method generates less fumes than the spray transfer method.

- **Gas Tungsten Arc Welding (GTAW)**

This process is also known as Tungsten Inert Gas Welding (TIG). This process uses a non-consumable tungsten electrode. The filler metal is added manually using a separate rod usually of similar composition to the base metal. TIG welding is used for pressure equipment welding, welding stainless steel, aluminium and other non-ferrous metals. Argon and helium are typically used as shielding gases.

Hazards

Welding fumes and vapours are a complex mixture of metallic oxides, silicates and fluorides. Fumes and vapours are formed when a metal is heated above its boiling point and its vapours condense into very fine particles, which are able to enter the body through inhalation causing asphyxiation and toxicity. Particles in the welder's breathing zone may remain in the air for some hours if they are not removed by ventilation.

The composition of the fumes and vapours vary depending on the materials being welded. Some substances found in welding fume and vapour are Lead, Cadmium, Manganese, Zinc, Iron, Chromium and Nickel.

Add coatings to the material and substances such as Hydrogen Cyanide, Formaldehyde, Isocyanate, Carbon Dioxide, Carbon Monoxide etc. may be formed.

Risk

Welding fumes and vapours have long been considered cancer causing agents.

Many cases of acute poisoning due to exposure to one or more welding fume or vapour have been documented.

Recent medical research is now connecting exposure to welding fume and vapour, and effects they have on the nervous system.

Of concern is the syndromes associated with toxic damage to the nervous system and brain disorders (Alzheimer and Parkinson's), and occupational exposure of welders to these fumes and vapours.

Evidence supports unprotected welding leads to neurological damage.

Risk Controls

Under the Occupational Health and Safety Regulations, 2017 (OHS Regs), Part 4.1 - Hazardous Substances, employers are required to control risks in accordance with the hierarchy of control.

Employers must have a Safe Work Method Statement (SWMS) advising their workers of the hazards and risks associated with their work in a contaminated atmosphere, and the control measures that are to be in place to remove or control the risk.

Consideration prior to welding would be, with reference to the hierarchy of controls:

- Ventilation
- The fumes and vapours created by the welding process
- Confined space
- Monitoring of the atmosphere
- Health surveillance
- Education and training
- First aid

Personal Protective Equipment (PPE) is inherent in the welding process, in the form of the welding helmet.

When considering the selection of a welding helmet, auto-darkening lenses with powered air purifying respirators (PAPR) must be selected.

Other considerations:

It is mandatory under the Occupational Health and Safety Act 2004 for employers to monitor the health of their workers.

Welders are advised to notify their doctor of their occupation when seeking treatment or having check-ups to ensure proper care and advice is given.

Other relevant material:

<https://www.worksafe.vic.gov.au/controlling-exposure-welding-fumes>

WorkSafe Victoria Industry Guidance: Controlling exposure to welding fumes.

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