

Weld Australia
Technical Guidance Note

Fume Minimisation Guidelines: Welding, Cutting, Brazing & Soldering

Foreword

This Technical Guidance Note provides weld fume control guidelines, originally produced as part of a research project of the Cooperative Research Centre for Materials Welding and Joining in 1997. The aim of the research was to establish which processes generated fume at levels which would need to be controlled to comply with the requirements of what is now the national *Code of practice – Managing the risks of hazardous chemicals*, and to provide advice on the control measures which could be introduced to achieve this.

This sixth edition of the *Fume Minimisation Guidelines* includes comment from the International Institute of Welding's Commission VIII *Health, Safety & Environment* on the 2017 ruling from IARC (an agency of the World Health Organisation) in relation to welding fume being reclassified from Group 2B *Possibly Carcinogenic to Humans* to Group 1 *Carcinogenic to Humans*. It also includes comment on minimising the welder's exposure to fume to:

- (a) Minimise the risk to the welder developing serious acute and long-term health issues; and,
- (b) Comply with statutory workplace exposure limits.

Acknowledgement

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Future Revisions

This Technical Guidance Note will be revised from time to time and comments aimed at improving its value to industry will be welcome. This publication is copyright and extracts from this publication shall not be reprinted or published without the Publisher's express consent.

Disclaimer

The use of these Guidelines cannot guarantee full compliance with the Codes of Practice. By following the methodology, a workplace will lessen or mitigate the risk of non-compliance. Further professional assistance, for example by occupational hygienists or ventilation engineers, may be advisable in those circumstances where the Guidelines may not be entirely applicable or unusual conditions prevail.

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Editor

Mr Bruce Cannon
Technical Publications Manager, Weld Australia

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Weld Australia

ABN 69 003 696 526
PO Box 197, Macquarie Park BC, NSW 1670
Phone: 1800 189 900
www.weldaustralia.com.au



About Weld Australia

Who We Are

Weld Australia represents the welding profession in Australia. Our members are made up of individual welding professionals and companies of all sizes. Weld Australia members are involved in almost every facet of Australian industry and make a significant contribution to the nation's economy.

Our primary goal is to ensure that the Australian welding industry remains both locally and globally competitive, both now and into the future.

A not-for-profit, membership-based organisation, Weld Australia is dedicated to providing our members with a competitive advantage through access to industry, research, education, certification, government, and the wider industrial community.

Weld Australia is the Australian representative member of the International Institute of Welding (IIW).

Our Vision & Mission

Our vision is to facilitate the growth of a world class welding industry in Australia.

Our mission is to create opportunities for our members and advocate welding policies and practices which protect the Australian public.

Our Value Proposition

Weld Australia generates revenue through its commercial activities which is then reinvested back into the welding community for the benefit of members.

Weld Australia brings individual and company members together to deliver:

- A forum for the exchange of ideas and the sharing of resources
- A voice to promote the interests of the welding community and shape the market for welding services
- Specialist technical problem solving and a conduit between industry and research organisations
- A pathway for learning and career development and the opportunity to benchmark against world's best practice

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- Events and Seminars
- Technical Publications
- Technical Support and Advisory Services
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- Professional Development
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Weld Australia has a team of highly qualified welding engineers and technologists available to provide expert advisory services on all welding related matters. With expertise in a wide range of industries, ranging from biotechnology to heavy engineering we have a unique capability to solve your welding problems.

Our advice can help you substantially increase the operational life of your plant and equipment and thereby reduce your maintenance and repair overheads.

Further Information

For further information about Weld Australia and how we can help your business, visit: www.weldaustralia.com.au.

Welding and the Risk of Cancer

Introduction

In March 2017, the International Agency for Research on Cancer (IARC) reclassified welding fume from Group 2B *Possibly Carcinogenic to Humans* to Group 1 *Carcinogenic to Humans*. Their assessment was subsequently published in IARC's Monograph 118 in July 2018.

The International Institute of Welding (IIW) through their Commission VIII experts, evaluated the findings published by IARC and a position statement was published as document *IIW-VIII-2290r2-21*.

Safe Work Australia has since revised its *Workplace exposure standards for airborne contaminants* reducing the permitted weld fume exposure limit from 5mg/m³ to 1mg/m³, effective from 18th January 2024 in all jurisdictions throughout Australia. They have also confirmed that workplace exposure limits (WELs) will replace these workplace exposure standards (WESs) commencing 1st December 2026.

Following discussions with Commission VIII, Weld Australia advises that the guidelines published within these *Fume minimisation guidelines* and Weld Australia's Technical Note 7 be followed.

Recommendations

Conduct a risk assessment, and in compliance with National and State WHS Regulations, identify the hazards and controls required (see Guideline 1) to ensure that the welder and people working nearby, are protected from exposure to fume from welding and welding-related processes (including thermal cutting, gouging etc.). See Appendix A for an example self-audit form to assist in identifying the hazards associated with weld fume. Control measures are discussed in Guideline 2.

The following actions, based on the hierarchy of controls, should be considered:

1. **Elimination:** Where practicable, either remove the welder from the source of the fume by mechanising or automating the welding process, or utilise a lower fume emission process or weld procedure.
2. **Substitute** a lower fume process:
 - (a) Optimise the weld procedure to maximise arc stability, minimise spatter and minimise weld fume production. Arc stability is enhanced through:
 - (i) use of an inverter-based welding power source; and,
 - (ii) use a copper-free wire consumable for the GMAW and FCAW processes.
 - (b) For the GMAW process, waveform controls are highly effective (up to 80% fume reduction possible) at reducing weld fume.
 - (c) For the GMAW and FCAW processes, reduce the CO₂ content of the shielding gas to minimise the amount of fume generated.
3. **Engineering controls:**
 - (a) At-source fume control is recommended to maximise the level of fume captured as it is generated. Fume management equipment such as hooded fume extractors (e.g. fixed, downdraft extraction table, portable) and on-gun extraction systems can remove up to 90% of the fume generated. Captured fume should be filtered and exhausted to atmosphere, preferably outside of the workshop in a non-hazardous area.
 - (b) A good overall ventilation system used throughout the workshop in conjunction with fume capture systems is essential for the protection of personnel working in the vicinity of welding. Accumulation of fumes in areas away from welding or welding related process in the workshop must also be prevented to ensure that co-workers are not exposed to the fume.
4. **Administration controls:** In conformance with these *Fume minimisation guidelines*, arrange the work piece so that the welder's head is not in the plume.

NOTES:

- (i) When welding in flat (PA, 1G or 1F) or horizontal-vertical (PB or 2F) position, the welder's head is likely to be positioned within the plume, and fume management methods or personal protective equipment (PPE), or a combination of both, may be required.
- (ii) All welding processes generate fume. The plume may not be visible to the welder or with some processes, the observer.

5. PPE: To ensure conformance with the 1mg/m³ exposure limit, the use of supplementary personal protective equipment is likely to be required (e.g. powered air purifying respirators or PAPR), especially if the welder's head is in the plume.

A combination of fume control methods that includes the use of fume capture systems, good general ventilation, and personal protective equipment such as powered air purifying respirators (PAPR) or air-fed helmets etc that minimises the welder's exposure to weld fume is recommended. Additional controls are required if welding stainless steels, hardfacing, or through coatings.

Where doubt exists on control effectiveness, WHS regulations requires that air monitoring be undertaken (see Guideline 2). In addition, if there is a lack of engineering controls in use, it is likely that a regulator will require air monitoring (fume assessment) to be performed by a hygienist. Portable real-time air monitors are available to assist fabricators to demonstrate compliance for those working near welding operations.

Specialist advice may be sought from an Occupational Hygienist e.g. www.aioh.org.au, particularly in the preparation and implementation of a risk assessment, and the verification of the application of the controls (i.e. air monitoring).