



A Welding Fume & Product Control Industry Review

An insight into the Welding Industry based
on a 2024 survey of over 1,350 welders

Introduction

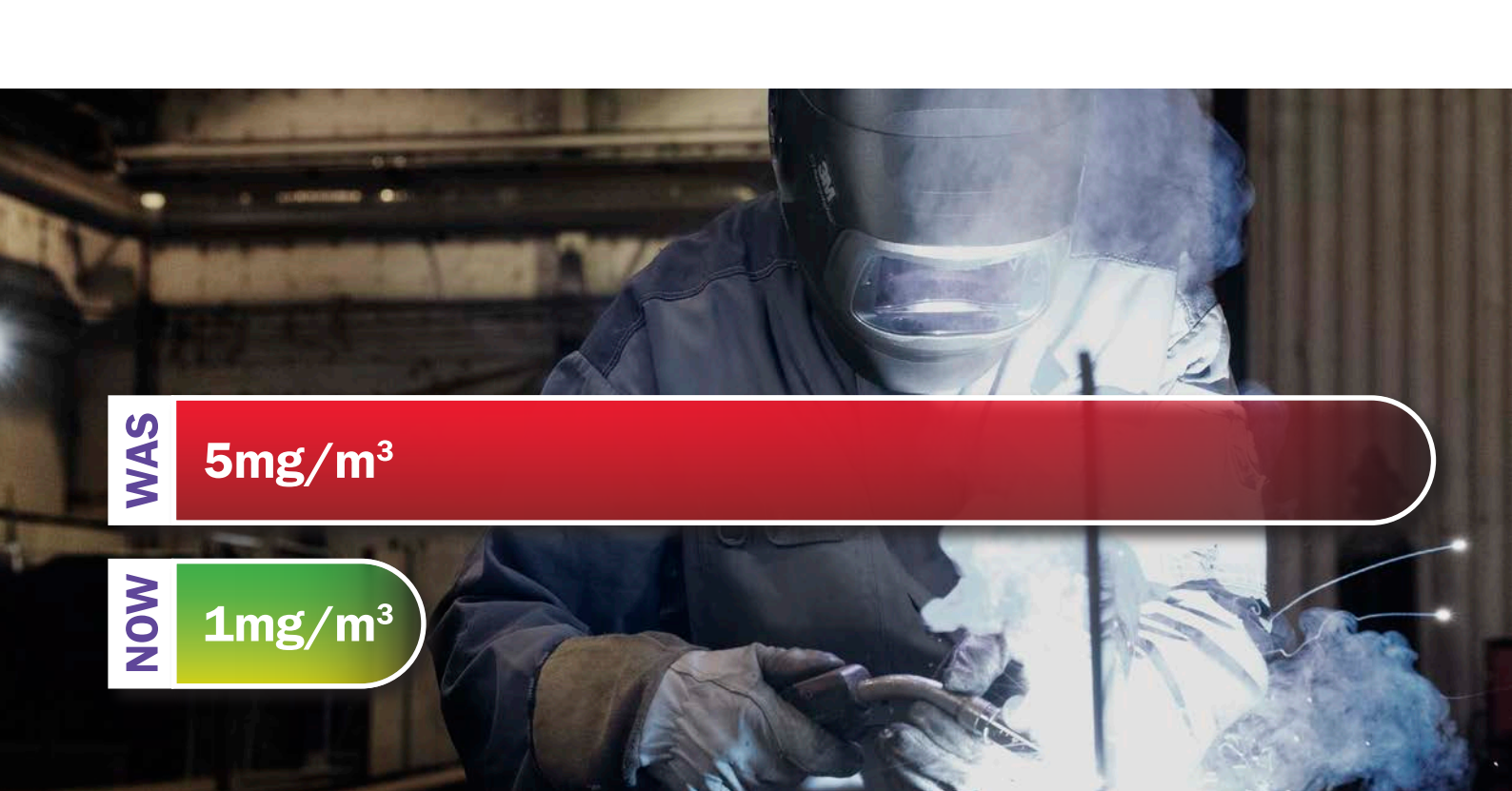
Based on a 2024* survey of over 1,350 welders across Australia, this review looks at the current state of the welding industry regarding welding fume exposure and welding fume product controls.

With the lower Workplace Exposure Standard (WES) for welding fume being introduced in January 2024, the objective of this survey was to understand whether the welding industry was aware of this change in legislation.

The survey then sought to determine what methods of welding fume product controls were being employed to reduce exposure to as low as possible, whilst ensuring levels were below the new limit as required by work health and safety legislation.



* This survey was conducted with 1,367 welders from 28th March 2024 to 30th June 2024.

A welder wearing a dark protective suit and a helmet with a clear visor is working. Sparks are visible from the welding process. Overlaid on the image are two callout boxes: a red one for 'WAS' and a green one for 'NOW'.

WAS

5mg/m³

NOW

1mg/m³

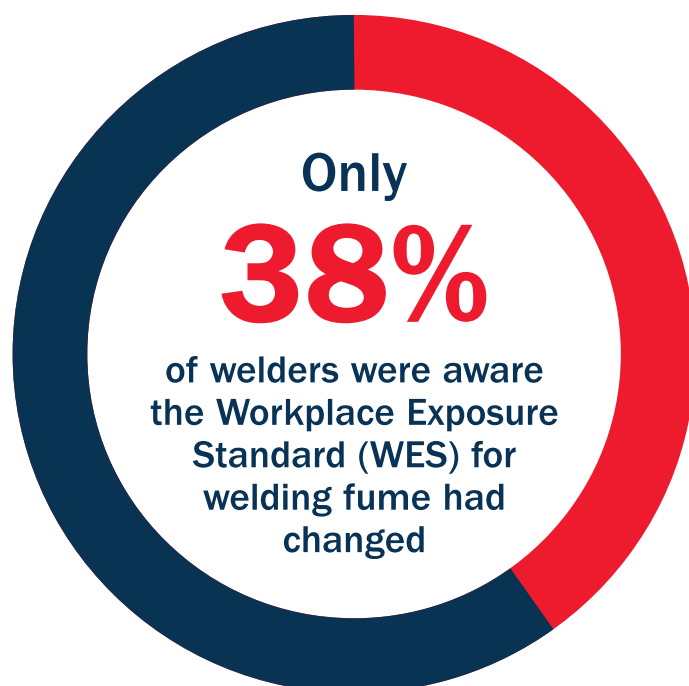
The New Workplace Exposure Standard (WES) For Welding Fume!

The Safe Work Australia Workplace Exposure Standard (WES) for welding fumes was lowered from **5mg/m³** to **1mg/m³** in January 2024.

This upper limit applies to welders, other workers in proximity to the welders, and anyone else who may be exposed to welding fumes in the workplace.

This is not optional, this is the law, which is actively being enforced by Health and Safety Regulators across Australia.

However, based on the results of the survey, only **38%** of welders were aware that the Workplace Exposure Standard (WES) for welding fume had changed - demonstrating that there is still a long way to go to ensure the industry is aware of the new legislation.

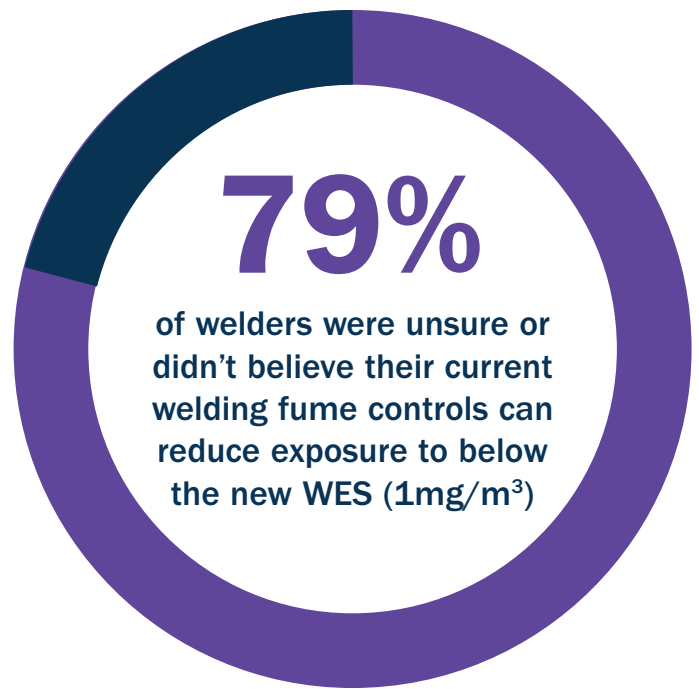


Scan the QR Code
to view the new
WES on the Safe
Work Australia
website!

Reducing Welding Fume Exposure Below the New WES

79% of welders were either unsure or didn't believe that their current welding fume controls are sufficient to reduce welding fume exposure to below the new **WES** ($1\text{mg}/\text{m}^3$).

While the figure above is likely mostly based on subjective feel as opposed to objective measurement, it is written into legislation that if a workplace is not certain on reasonable grounds whether the welding fume levels at the workplace exceed the new WES, the employer must ensure that air monitoring is carried out.



For personal air monitoring of your workers, it's recommended you contact the Australian Institute of Occupational Hygienists (AIOH): scan the QR code for contact details.



Scan to view the Australian Institute of Occupational Hygienists Website

If you are simply looking for a cost-effective way to get a better understanding of your workplace air in relation to the new workplace exposure limit for welding fume, a real-time air monitor can be introduced to measure fume levels and keep you continuously updated.



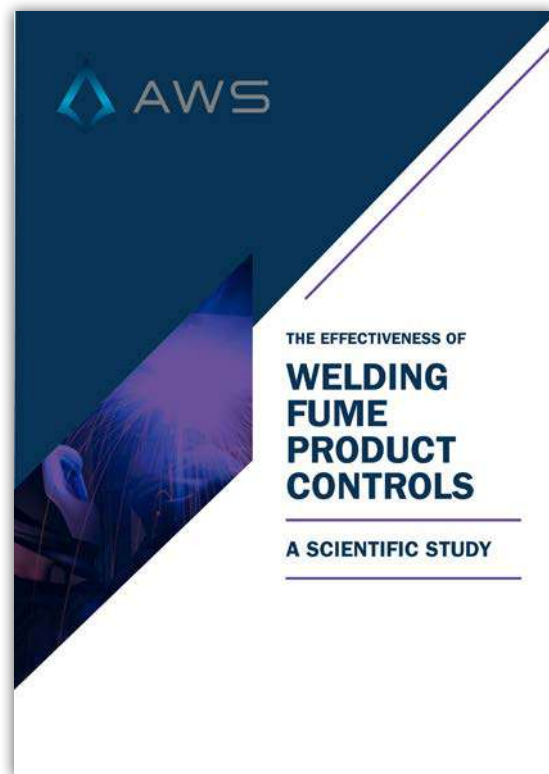
Scan here to learn more about real-time air monitors!

Effectiveness of Product Controls

Without adequate controls when welding, research shows that typical welding fume and ozone exposures to welders are highly likely to exceed their respective regulatory workplace exposure standards, placing workers at risk of irreversible lung disease, including cancer, and other adverse health effects.

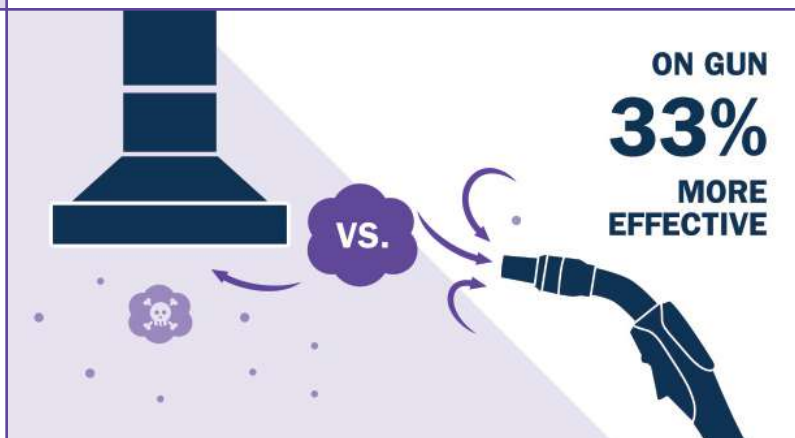
While the risk posed by welding fume is serious, it's vital to understand that keeping welders safe can be straightforward.

An independent Australian scientific study published in 2023¹ compared the effectiveness of different welding fume product control methods in reducing exposure to welding fume.



The peer-reviewed study demonstrated that a Welding Helmet with an Integrated Powered Air Purifying Respirator was by far the most effective control measure in protecting the welder from welding fume exposure when compared to On-Gun Fume Extraction and Hooded Capture LEV¹.

The same study demonstrated that On-Gun Fume Extraction LEV was **33% more effective** than Hooded Capture LEV in extracting welding fume from the environment¹.



Scan here to view the full results of this Scientific Study!

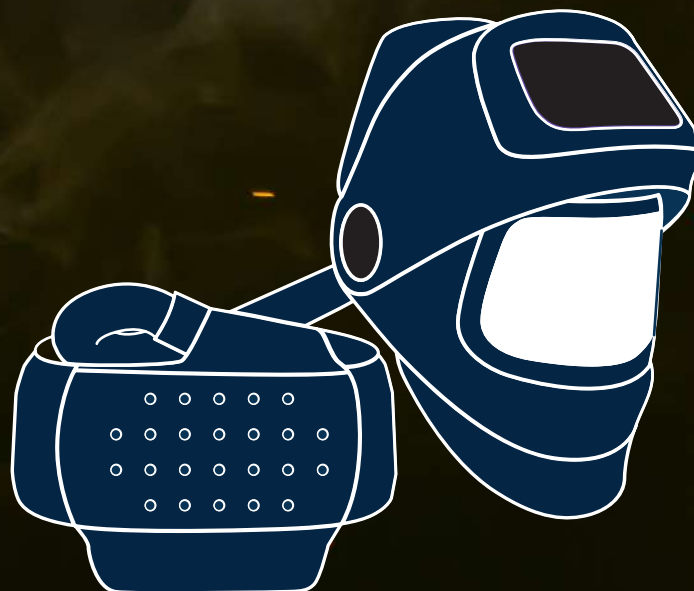
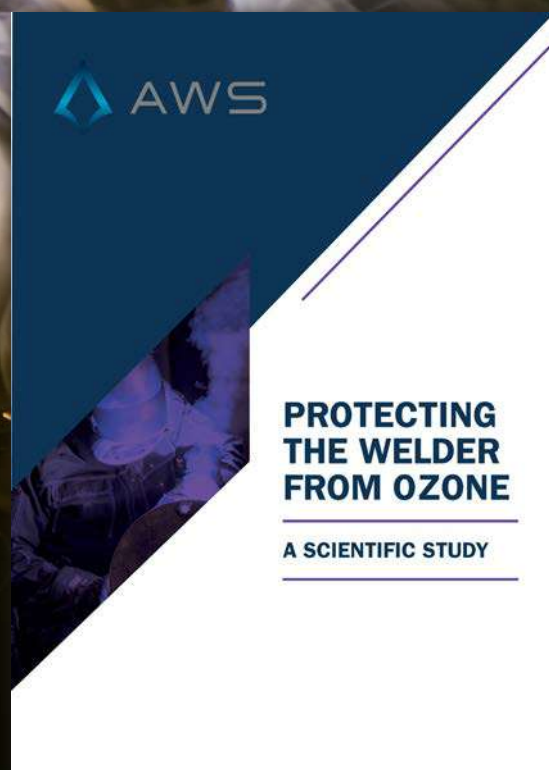
Another independent study conducted in 2023² found that a Welding Helmet with PAPR was able to effectively reduce the welder's exposure to ozone by **100%**. The same study indicated that on-gun fume extraction (on its own) may not be a reliable method to protect the welder from potential exposure to ozone. Based on the results of this study, ozone didn't appear to pose a danger to surrounding workers².

Based on the results of the studies referenced above, in an environment shared by welders and other workers, a combination of product controls is recommended:

- A PAPR alone is an extremely effective method to protect the welder from welding fume and ozone but does not protect surrounding workers.
- Engineering controls may remove fume, helping to protect surrounding workers, but may not be effective in protecting the welder from ozone and are significantly less effective than a welding helmet with PAPR in protecting the welder from welding fume.

Therefore, from a product control perspective, if the goal is to reduce welding fume and ozone exposure to as low as reasonably practicable for welders and others who may be exposed, a combination of a Welding Helmet with PAPR and an appropriate engineering control is recommended.

Based on the respective effective protection factors referenced within the studies^{1,2}, there is little doubt that the above approach if implemented correctly, will reduce both welding fume and ozone to below their respective WES, for both welders and those who work around welders, in a properly-ventilated environment.



Scan here to
view the results
of the Ozone
Scientific
Study!

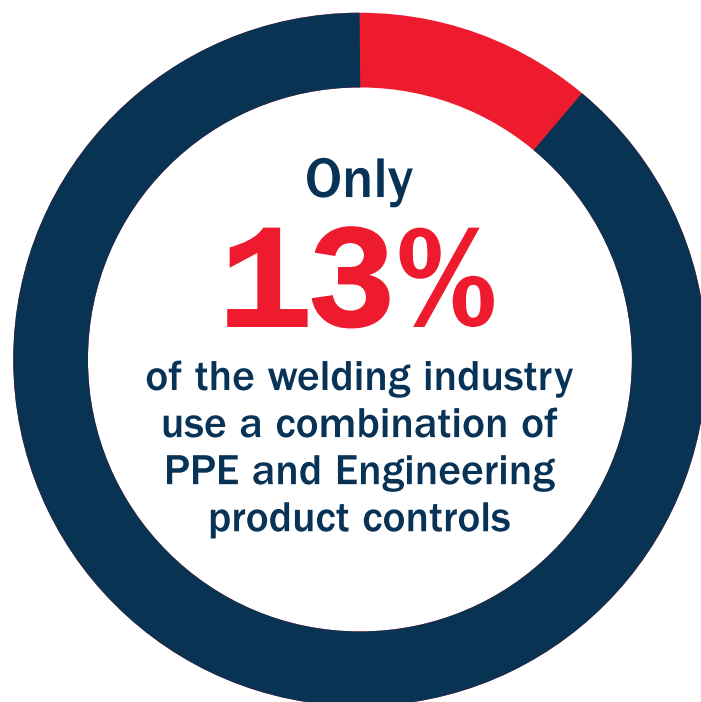
Industry Review - Welding Fume Product Controls

Please note that respondents could select multiple forms of control, so the individual percentages won't necessarily add up to the category totals below.

A Combination of Product Controls

While a combination of PPE and Engineering product controls is recommended, the survey demonstrated that only **13%** of the welding industry puts this into practice. This could potentially mean that **87%** of the industry is either leaving their welders or their surrounding workers exposed.

Worryingly, even with everything that is known about the adverse health effects linked to exposure to welding fume, **1/3** of workplaces didn't use *any* form of protection (PPE or engineering controls) to minimise exposure to welding fume.



Engineering Controls

41% of respondents reported that a welding fume haze is visible in the morning before any welding has been conducted, indicating that there could be poor ventilation and engineering controls are not being used effectively or the wrong engineering control is being used to try to remove welding fume from the environment.



For example, with Hooded Capture LEV, research has shown that exposure to welding fume can approximately double when the capture hood distance from the arc is increased from 30cm[^] to 50cm¹.

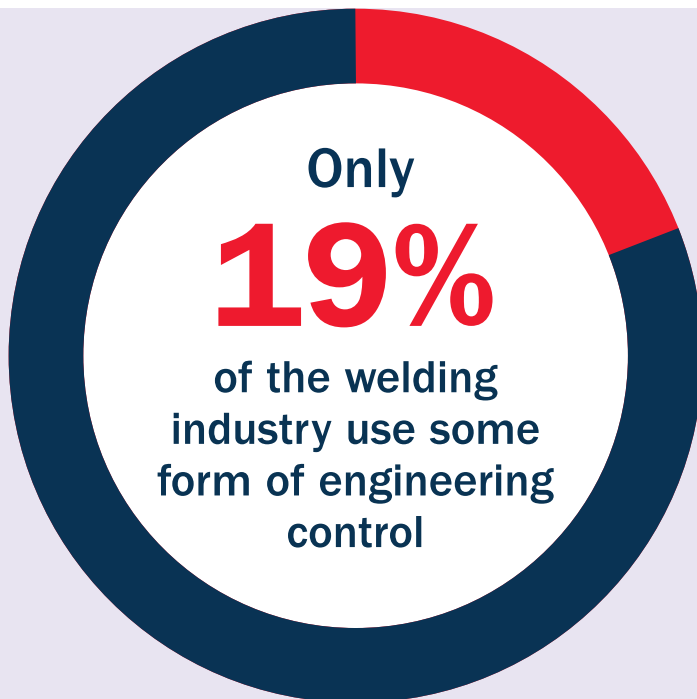
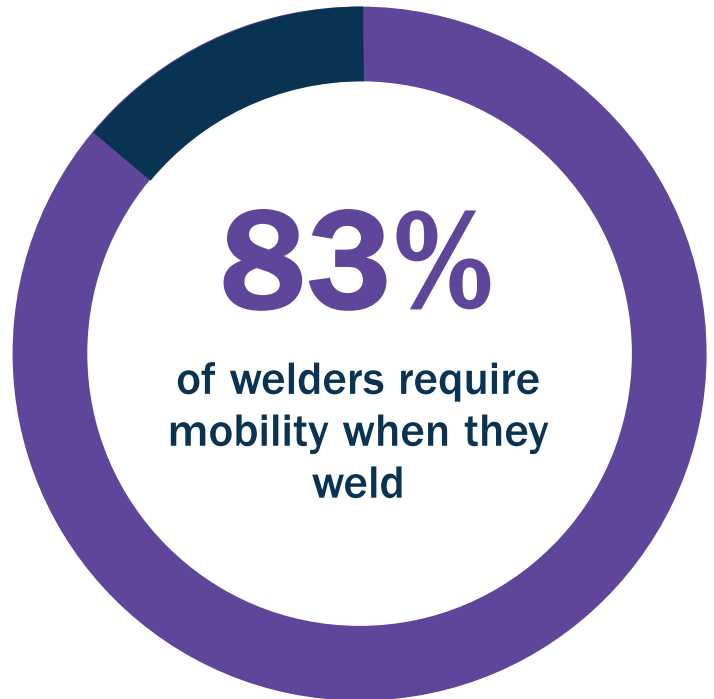
Therefore, welders using Hooded Capture LEV who require mobility and move away from the capture hood could be exposed to high levels of welding fume and also contribute to the welding fume haze in the workshop. Conversely, on-gun fume extraction follows the welder as the welder moves, capturing welding fume directly at the source, making it an ideal solution for welders who require mobility.

[^] Manufacturer's instructions for this piece of equipment indicated that the arc should be positioned approximately 30cm from the capture hood.

The survey demonstrated that **83%** of welders require mobility when they weld, which indicates that hooded capture LEV is potentially only suitable for the remaining **17%** of the welding industry who remain stationary while welding (e.g. welding at a bench).

The results of this survey further reinforce the need to match the correct engineering control to the welder's process, needs, and environment.

The survey found that only **19%** of the industry use some form of engineering control. This means that as many as **81%** of workplaces may not be doing enough to minimise welding fume in the workshop environment, potentially leaving surrounding workers exposed to excess welding fume.



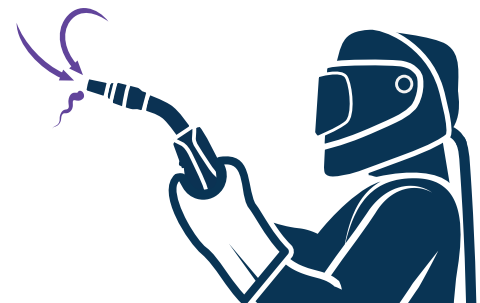
15% of welders use Hooded Capture LEV while only **3.5%** use on-gun fume extraction. **3%** use downdraft benches.

The use of on-gun fume extraction has increased by **250%** in recent years, up from **1%** in 2021³.

This is likely due to recent technological advancements that have decreased the size and weight of fume torches and ensured that the extraction process has zero impact on the shielding gas, while delivering extremely high capture efficiency compared with hooded capture.

On-gun fume extraction is also the only welding fume product control that removes welding fume from the environment and follows the welder as they move.

Regulatory inspectors will be following the hierarchy of control and will be looking to see that engineering controls are in place with a preference for on-gun fume extraction where possible. Even where respiratory protection is being worn, they will expect employers to implement higher order controls, so far as reasonably practicable.



Scan here to learn more about On-Gun Welding Fume Extraction!

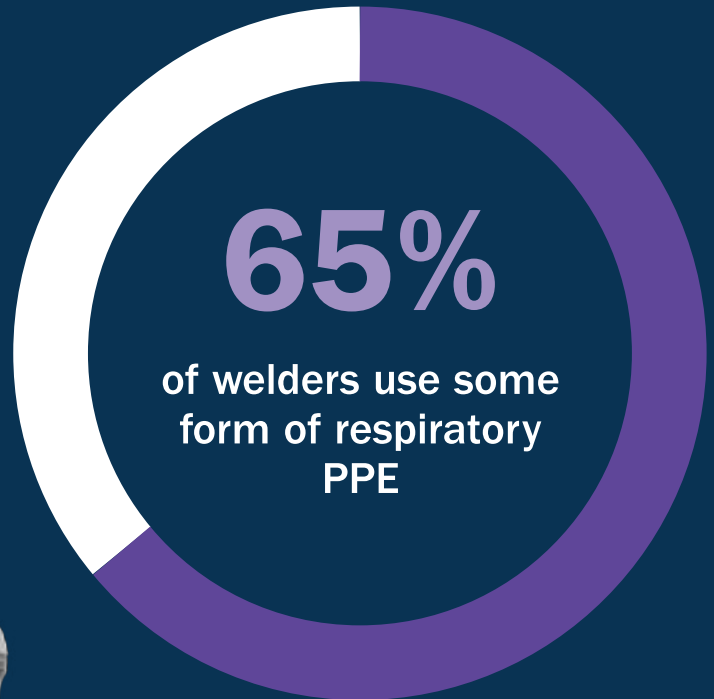
Personal Protective Equipment (PPE)

65% of welders surveyed use some form of PPE to protect the welder from welding fume.

This includes disposable half mask respirators, reusable half mask respirators, or welding helmets with powered air purifying respirators (PAPR).



A Welding Helmet with integrated Powered Air Purifying Respirator (PAPR)



37% of respondents said they use a welding helmet with powered air purifying respirator, which remains the most popular product control to protect welders.

The popularity of PAPR is likely based on its practicality, comfort, and its extremely high effectiveness in protecting the welder from both welding fume and ozone.

27% use disposable half mask respirators and 26% use reusable half mask respirators.

While half mask respirators can reduce exposure to welding fume if correctly worn, it's important to understand that a standard particulate disposable respirator (e.g. P2), often worn by welders under a welding helmet, will not provide effective protection from ozone. This style of respirator is designed to protect the wearer from particles.

Unlike welding fume, which is comprised of very small particles, ozone is a gas.



Disposable Half Mask Respirator



Reusable Half Mask Respirator

Research has demonstrated that a welder performing the most common welding processes including TIG, FCAW, and MIG can be exposed to levels of ozone far above the WES peak limitation (0.1 ppm peak limitation) within as little as 10 minutes²:

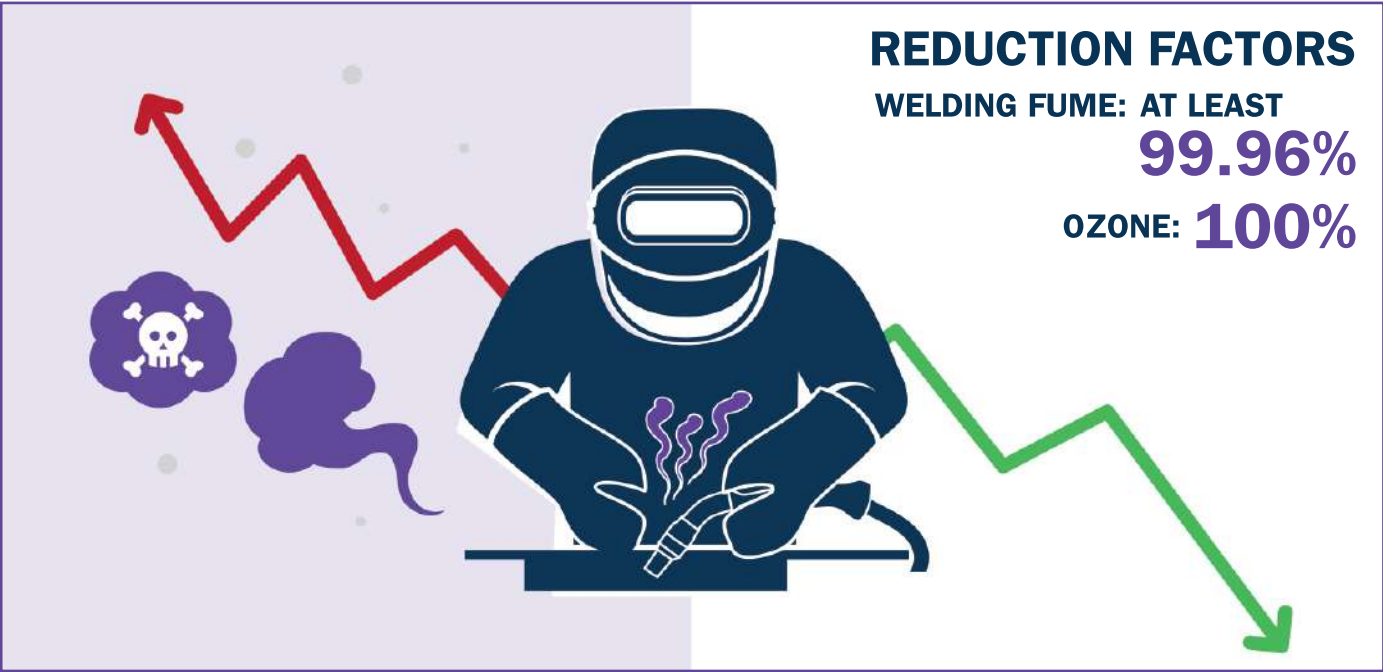
Welding Process	Max. Ozone Concentration [^] : Personal Monitoring (ppm)
Metal Inert Gas (MIG)	0.19
Flux Cored Arc Welding (FCAW)	0.15
Tungsten Inert Gas (TIG)	0.24
Manual Metal Arc Welding (MMA/Stick)	0.03

[^] Max Ozone Concentrations within 10 minutes - 2023 Protecting the welder from Ozone, A scientific study, AWS.

Therefore, welders should always wear respiratory protection that can protect against both welding fume (particles) and ozone (gas), regardless of time spent welding.

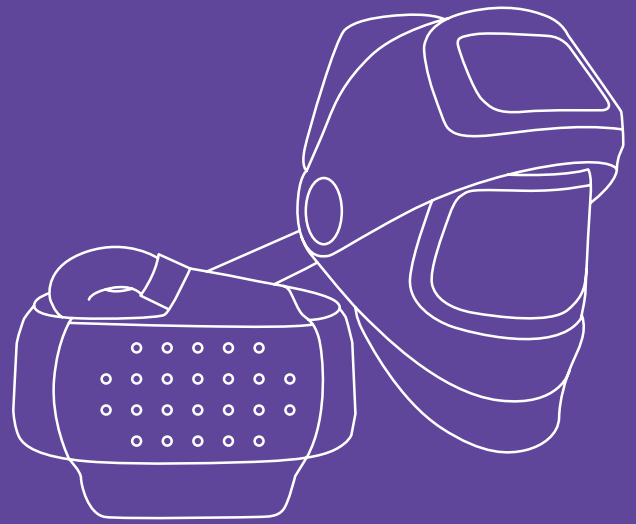
Specialty half mask respirators are available that can provide protection from welding fume and ozone. However, compared to a Welding Helmet with a PAPR, half mask respirators have a lower protection factor, must be fit tested on the individual wearer, can't be worn with any interfering facial hair, and may be a more expensive long-term option – especially if specialty respirators with protection from ozone are worn and replaced as per the manufacturer's guidelines.

A Welding Helmet with a Powered Air Purifying Respirator can reduce exposure to welding fume by at least 99.96%¹ and exposure to ozone by 100%². Measurements for ozone taken within the PAPR during the referenced study recorded 0.00ppm across all welding processes, across all tests, at all times, even when peak concentrations far above the WES were being recorded outside the welder's hood².



Key Takeaway

For workplaces wanting to reduce the welder's exposure to ozone and welding fume to as low as reasonably practicable, a Welding Helmet with a Powered Air Purifying Respirator should be considered a priority, regardless of the time spent welding.

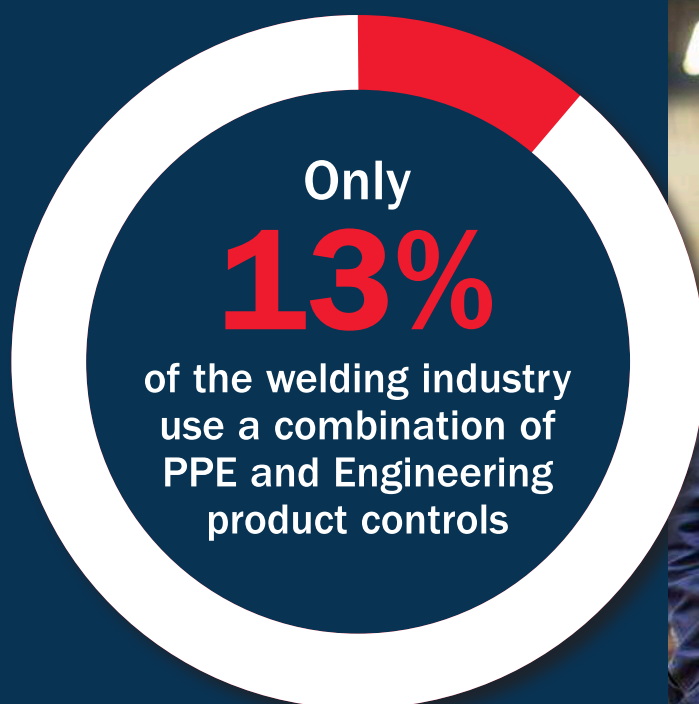


What's holding the industry back from introducing the right controls?

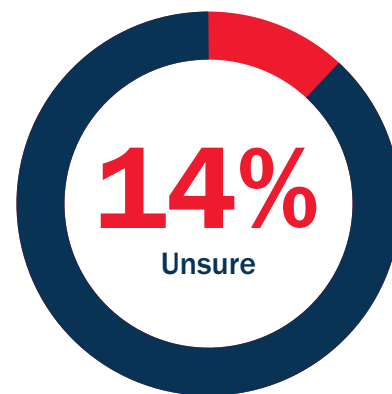
With recent research into the effectiveness of welding fume product controls, determining which PPE and engineering controls can be introduced to best protect your welders can be relatively straightforward.

Based on the results of the referenced studies, a welding helmet with PAPR is the most effective product control method to protect the welder from welding fume and ozone in well-ventilated environments and on-gun fume extraction, if suitable for the process*, is the most effective and practical product control method to remove fume from the environment, protecting any nearby non-welders who may be exposed to fume.

However, while it is well known that a combination of product controls will likely be the most effective method, why is it that only **13%** of the industry are rolling out this approach?

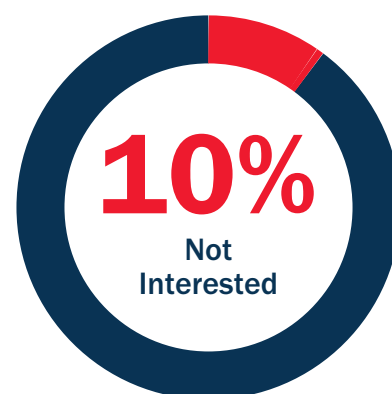


12% of the industry reported that it is on their agenda, and they are planning to introduce the required welding fume controls, however, they are extremely time poor.



14% of the industry reported they are unsure what to do.

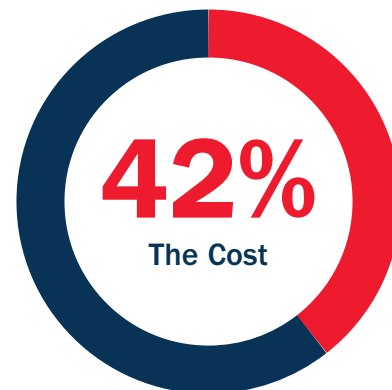
22% already believe they are reducing welding fume to as low as reasonably practicable and as a result don't plan to roll out further controls.



10% said they are not interested in doing anything further.

However, the largest group, made up of **42%**, stated that it is the cost of welding fume product controls that is holding them back.

For this last group, it would be worth getting in touch with a welding fume product control expert to assess your environment and suggest cost-effective methods of control.



In recent years, there has been an increase in budget-friendly welding fume product control options.

To speak with a welding fume product control expert about more affordable product control options or for a free workplace assessment, please contact AWS (see QR code below).

* Please note that On-Gun Fume Extraction is not suitable for all welding applications (e.g. MMA stick welding) and certain variables can impact effectiveness (e.g. design of the on-gun extraction system and welding gun, weld position, and environmental factors).



**Scan here to
contact a welding
fume product
control expert!**

Where to from here?

Welding can and should be considered a safe occupation; when proper precautions are taken, welders have no cause to fear accident or injury. But when safety isn't taken seriously in the workplace, the risk of a severe incident becomes a real concern.

Education and clear guidance is the key to ensuring a safe and productive working environment for everyone. The information from the referenced studies should empower employers and welders to better understand the risks associated with welding, the mitigation strategies they can use, and the equipment available to prevent accident and injury.

The results from the survey highlight that there is still much work to be done to ensure welders and those who work around welders are protected from welding fume and ozone.

To review the referenced studies, please use the QR codes below:



**The Effectiveness Of
Welding Fume Controls:
A Scientific Study**



**THE EFFECTIVENESS OF
WELDING
FUME
PRODUCT
CONTROLS**

A SCIENTIFIC STUDY



**Protecting The Welder
From Ozone:
A Scientific Study**



**PROTECTING
THE WELDER
FROM OZONE**

A SCIENTIFIC STUDY

Contact a Welding Fume Expert

To speak with a welding fume product control expert or for a free workplace assessment, please contact AWS.



Scan here to contact a welding fume product control expert!

Welding Fume Product Control Selector

Or to use the welding fume product control selector please use the QR code below.

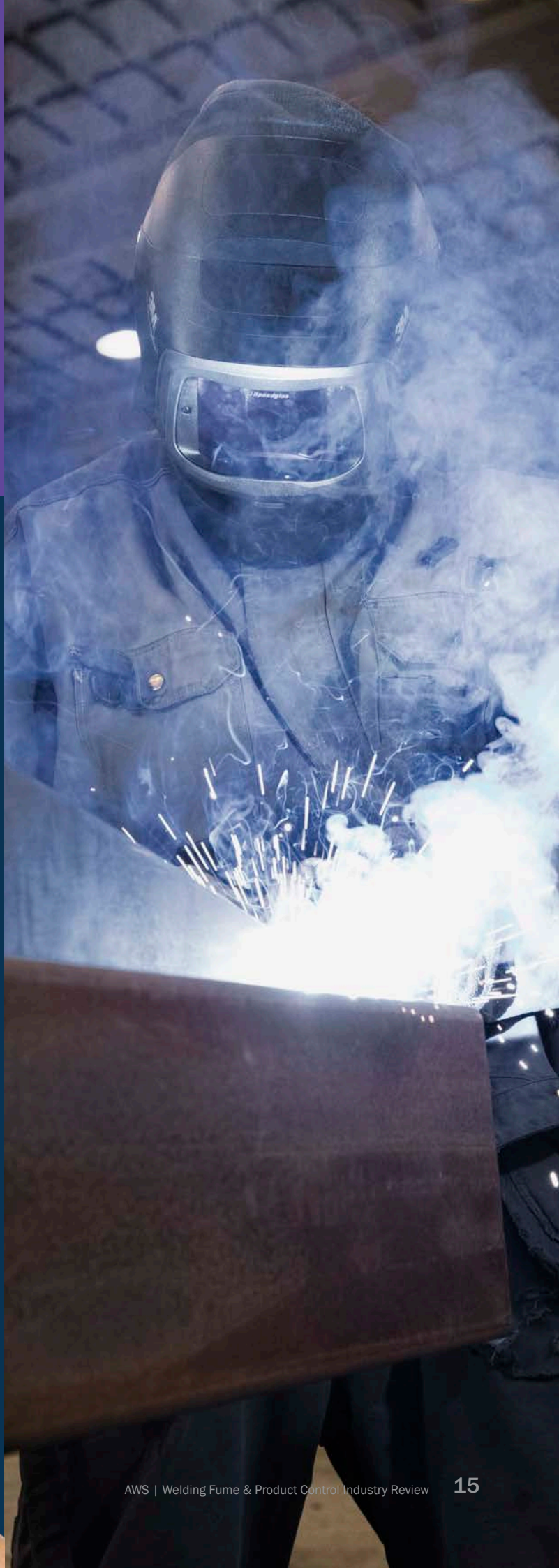


Scan here to use the Welding Fume Product Control Selector!

For anything else or further information, please contact AWS.

T: (02) 9439 0111

E: sales@apexweldingsafety.com.au





AWS was established in 1994 and has played a key role in the welding industry ever since.

As an advocate for welders' safety in Australia and New Zealand, AWS has published numerous Welding Safety White Papers, Welding Industry Reports, and Welding Fume Control Frameworks. AWS is a company that specialises in welding safety equipment, and it is our goal to raise awareness on the important issues that welders face.

AWS supplies all forms of welding fume product controls including half mask respirators, auto-darkening welding helmets with powered air purifying respirators, hooded capture LEV, on-gun fume extraction, downdraft benches, and general filtration options (push-pull and diluters).

For more information on welding fume monitoring, welding respiratory protective equipment, or welding fume extraction options, please contact AWS.

www.apexweldingsafety.com.au

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¹ 2023 Peter Knott, Georgia Csorba, Dustin Bennett, Ryan Kift. Welding fume; a comparison study of industry used control methods. Safety Journal.

² 2023 Protecting the welder from Ozone, A scientific study, AWS.

³ 2021 Welding Method, Material, and Consumable Survey, AWS.

IMPORTANT

The reported survey statistics were based on a survey conducted with 1,367 welders from 28th March 2024 to 30th June 2024.

Powered air respirators must never be used in atmospheres Immediately Dangerous to Life or Health (IDLH). Always consult your Safety Engineer or Occupational Hygienist. Air monitoring should take place if you are unsure about the level of welding fume or ozone exposure to workers.

Brands and product names have been omitted to keep this paper focused solely on the different forms of product controls as opposed to pushing specific brands or products. However, it's important to note that the results referenced in this document are only applicable to the brands and products used in the study – this information can be made available upon request.

The key results and the guidance within this document do not address confined spaces. See relevant Codes of Practice and State regulations applicable to your jurisdiction for more information. Confined spaces should be avoided where possible. All of today's current welding fume and ozone product controls have their limitations in a confined space. There should be a suitably trained and knowledgeable person doing the assessment and design of a safe system for any confined space entry. Consultation with a product control expert should always be carried out to understand the limitations of each product control within a confined space.

This publication contains work health and safety information and is provided as guidance, it should not be relied upon as legal compliance. It includes obligations under legislation that health and safety regulators administer. To ensure you comply with your legal obligations you must refer to the appropriate legislation. This publication does not represent a comprehensive statement of the law as it applies to particular problems or to individuals or as a substitute for legal advice.

You should seek independent legal advice if you need assistance on the application of the law to your situation.