



**CONTROLLING EXPOSURE RISKS  
FROM WELDING AND CUTTING PROCESSES**

*Last updated: October 2025*

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# ACKNOWLEDGEMENT

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This guide has been adapted from the publication **Controlling Exposure Risks from Welding and Cutting Processes**, originally developed by WorkSafeBC. We acknowledge and appreciate WorkSafeBC's contribution in creating the original resource and thank them for granting permission to adapt the content.

The original guide by WorkSafeBC also incorporated materials developed by WorkSafe New Zealand and the Health and Safety Executive (United Kingdom). These contributions are respectfully recognized and maintained in this adapted version.

The content has been modified to reflect Prince Edward Island's *Occupational Health and Safety Act* (OHS Act) and General Regulations, as well as workplace conditions and best practices specific to our province. While core health and safety principles remain unchanged, updates have been made to make sure the content is aligned with PEI legislation and supports compliance efforts by Island employers and workers.

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# CHAPTER 1 - ABOUT THIS PUBLICATION

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## 1.0 Introduction

This guide is intended for employers and workers in Prince Edward Island who perform welding work. It provides information on the health risks associated with welding, along with practical steps to reduce exposure and protect workers. Welding and cutting processes can release a complex mixture of hazardous substances. These substances can pose serious health risks in any setting, but the dangers increase significantly when welding is done indoors, in confined spaces, or where inadequate ventilation can lead to higher concentrations of hazardous substances. Understanding the risks and applying effective control measures are essential to maintaining a safe and healthy work environment. Both employers and workers share responsibility for identifying hazards, implementing controls, and making sure safe practices are consistently followed.



### For additional support, please contact:

Workers Compensation Board (WCB)

Occupational Health and Safety (OHS) Division

**Email:** [ohs@wcb.pe.ca](mailto:ohs@wcb.pe.ca)

**Phone:** 902-569-0449 or 1-800-237-5049 toll-free  
in Atlantic Canada

**24-Hour OHS Emergency Line:** 902-628-7513

### For additional resources:

- Visit our website at [wcb.pe.ca](http://wcb.pe.ca)
- Download our **Guide to OHS Legislation App** available for iOS and Android

Find and follow us on



## 1.1 What is the *Occupational Health and Safety Act (OHS Act)*?

The **OHS Act and its Regulations** set the minimum standards for occupational health and safety in the workplace and define the general safety principles for provincially regulated workplaces in Prince Edward Island. A safe workplace starts with employers and workers understanding the OHS Act and its Regulations.

**Section 12 of the OHS Act** states that employers must take every reasonable precaution to protect the health and safety of individuals at or near the workplace. This includes making sure that machinery, equipment and materials are in safe working condition, and that workers are provided with adequate training and supervision. Employers are also required to identify and eliminate workplace hazards to help prevent incidents and injuries.

In PEI, the **WCB's OHS Division** enforces the following legislation and regulations at workplaces and work sites:

- *Occupational Health and Safety Act (OHS Act)*
- OHS Act General Regulations
- Fall Protection Regulations
- Scaffolding Regulations
- Workplace Hazardous Materials Information System (WHMIS) Regulations
- Workplace Harassment Regulations
- *Smoke Free Places Act*
- *Youth Employment Act*

This publication is not intended as a form of legal advice and should not be taken as a statement of the law. The information provided in this guide is for general application and therefore, the reader should always refer to the OHS Act and its Regulations for specific requirements.

**Visit our website [wcb.pe.ca](http://wcb.pe.ca) for more information and additional resources.**

# CHAPTER 2 - RESPONSIBILITIES UNDER THE OHS ACT

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## 2.0 Employer responsibilities

Under Prince Edward Island's OHS Act, employers must take every reasonable precaution to protect the health and safety of individuals at or near the workplace. **Part 11 of the OHS Act General Regulations** outlines how employers must also make sure that workplaces are adequately ventilated so that the atmosphere does not endanger the health and safety of workers, like when they are welding.

Welding fumes and gases often contain substances that are carcinogens, sensitizers, or reproductive toxins. The International Agency for Research on Cancer (IARC) classifies welding fumes and ultraviolet radiation from welding as human carcinogens. **A carcinogen is any substance that can cause or promote the development of cancer.**

For information on what may be in welding fumes, **refer to the safety data sheets (SDSs)** for the types of metal being welded, the consumables like welding rods or wire, and the shielding gases. An SDS will describe the composition of the products being used and any related hazards. Other resources that help identify potential metals in welding fumes include the specifications for base metals in use and the welding certificates for the consumables in use.

Employers should implement an **exposure control plan (ECP)** and follow the **ALARA principle** to control exposure to welding fumes.

### WHAT DOES ALARA MEAN?

ALARA means that all exposures must be kept

**As Low As Reasonably Achievable**

below the exposure limits for the designated substances.

**Part 11.3 of the OHS Act General Regulations** about ventilation in the workplace includes Threshold Limit Value (TLV) instructions.

Employers must take all reasonable measures to eliminate exposure or reduce it below TLVs.

## 2.1 What this guide covers

This guide focuses on exposures to welding fumes and gases. It outlines key strategies for controlling the risks associated with welding fumes and gases, organized according to the hierarchy of controls:

- Elimination
- Substitution
- Engineering controls, including local exhaust ventilation (LEV) and dilution ventilation
- Administrative controls
- Personal protective equipment, like respiratory protection

Together, these controls form a comprehensive approach to managing welding-related health risks.

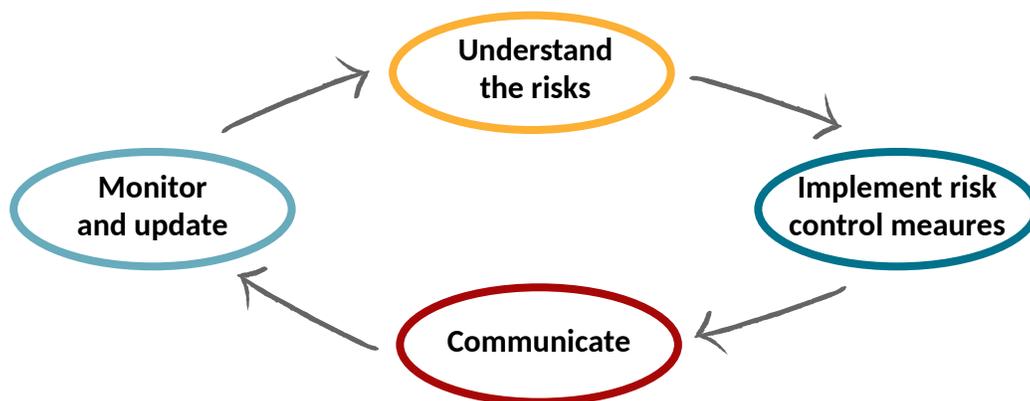


**Other hazards, including but not limited to UV radiation, electricity, fire, and ergonomics must also be controlled in welding operations.**

## 2.1 Managing risks

There are **four steps to managing risks** in the workplace:

1. Understand the risks by identifying hazards and assessing the risks associated with those hazards.
2. Implement measures to control the risks, following the hierarchy of controls.
3. Communicate your risk management program to managers, supervisors, and workers.
4. Monitor the effectiveness of your control measures and improve those that are not working as intended.



Always consult your Joint Occupational Health and Safety Committee (safety committee) or Safety Representative, along with workers familiar with the work processes, at each step of the risk management process.

**For more information, see the Guide to Performing a Hazard Assessment at [wcb.pe.ca](http://wcb.pe.ca)**

# CHAPTER 3 - UNDERSTANDING HEALTH RISKS ASSOCIATED WITH WELDING EXPOSURE

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## 3.0 Health effects of welding emissions

Welding and cutting processes can produce:

- **Fumes** from manganese, chromium, nickel, beryllium, other toxic metals, and fluorides.
- **Gases** like from nitrogen oxides, carbon monoxide, carbon dioxide, ozone, and shielding and fuel gases.
- **Other gases and vapours** that are either by-products of the breakdown of solvents or coatings on the metal, or are formed because of interactions with chemicals in the air.

Welders and others nearby who inhale welding fumes, gases, or vapours are at risk of developing occupational diseases and illnesses.

Exposure to welding fumes, gases or vapours can have **immediate health effects**, such as metal fume fever and irritation of the eyes, nose and throat. Metal fume fever is a flu-like condition.

Potential **health effects of long-term work-related exposure** to welding fumes include:

- Metal fume fever
- Neurotoxicity, which is the damage or dysfunction of the nervous system
- Asthma
- Lung cancer
- Chronic obstructive pulmonary disorder (COPD)

On rare occasions, **there have been fatalities** when working with base metals or rods that contain very toxic metals, such as beryllium or cadmium.

Shielding gases used in welding processes can cause suffocation from a lack of oxygen. This usually happens when the gases accumulate in confined spaces or in oxygen deficient atmospheres.

See **Appendix A, B and C** for a detailed list of fumes, gases, and organic vapours that are produced during welding, and the health effects associated with each of them.

### 3.1 Exposure limits

Without effective controls in place, levels of welding fume and gas components in the air can easily exceed exposure limits, which are set at levels to minimize adverse health effects. The exposure limits for some elements and chemical compounds are very low. Increased exposures can happen when welding mild steel, stainless steel and other alloys. **Both indoor and outdoor welding can result in high exposure levels.**

### 3.2 Understanding the risks

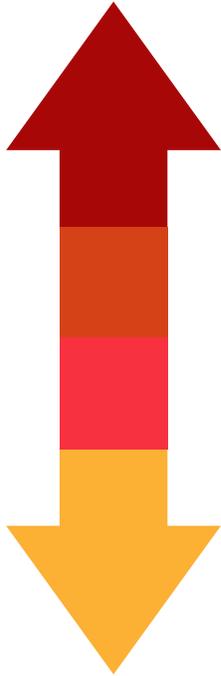
The first step when managing workplace risks is to understand the risks. **Start by identifying potential hazards in your workplace**, and then assess the risks associated with those hazards. A risk assessment will help you determine what type of risk control measures you will need to eliminate the hazards or reduce the risks.

**When doing a risk assessment for welding, consider the following questions:**

- What types of metals are being welded: mild steel, stainless steel, galvanized steel, or aluminum?
- What welding processes are being used: tungsten inert gas [TIG], metal inert gas [MIG], air carbon arc gouging, or brazing? Which of these processes generate the most fumes?
- Are there welding processes that generate hazardous gases such as ozone, carbon monoxide or oxides of nitrogen? Will potential exposures to these gases require additional controls?
- What consumables, like welding rods or wire, and shielding gases are being used? Check SDSs for information on welding electrodes, rods and shielding gases.
- What other factors may affect the amount of fumes generated, like current and voltage, arc time, flux usage, electrode size and type?
- What substances are likely to be in the fumes? What are the risks associated with them?
- Are welding surfaces coated or painted with lead-based paint, epoxy resins, degreasing agents or rust inhibitors that must be removed before welding?
- What controls are currently in use like respirators, ventilation, welding booths? Are they being used correctly and are they properly maintained?
- Where is the welding being done: outdoors, indoors or in a confined space? What is the degree of confinement?
- Who is exposed to the fumes and gases? How often are they exposed - daily or occasionally - and for how long?
- Are exposure monitoring results available?

## Reference - Amount of fume for different welding processes

Highest fume



Lowest fume

- Air carbon arc gouging, flux core
- Shielded metal arc (stick) welding
- Cutting metal inert gas (MIG)
- Tungsten inert gas
- Laser cutting, resistance welding, submerged arc

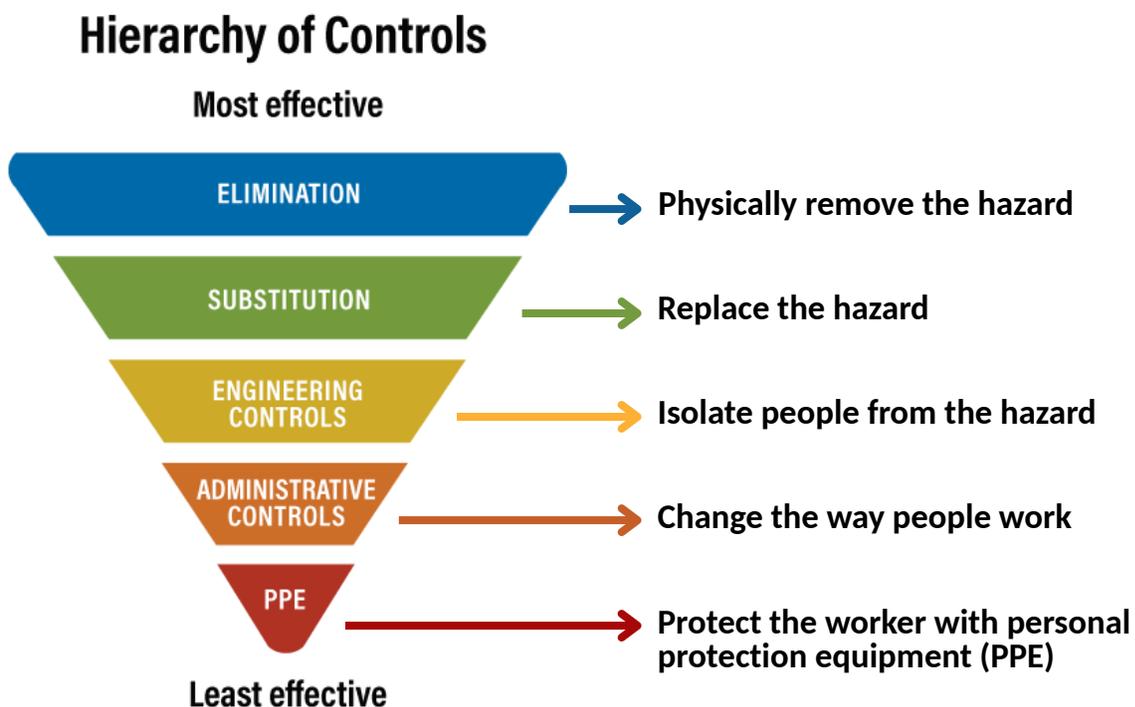
Visit our website [wcb.pe.ca](http://wcb.pe.ca) for more information and additional resources.

# CHAPTER 4 - IMPLEMENTING MEASURES TO CONTROL THE RISKS

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## 4.0 Hierarchy of controls

Once you understand the risks involved in the welding process in your workplace, the next step is to take action to control those risks. **There are five basic ways to control hazards, commonly known as the hierarchy of controls.** They are listed below in order of effectiveness, beginning with elimination, which involves the physical removal of the hazard.



In many cases, a hazard cannot be eliminated or effectively managed using a single control method. When this happens, **a combination of controls should be used to provide a higher level of protection.** These may include engineering controls, administrative measures and PPE.

**Give priority to controls that protect multiple workers at once.** For example, local exhaust ventilation (LEV) helps protect everyone in the workspace, whereas a respirator only protects the individual wearing it. Using both controls together can offer even greater protection.

## 4.1 Elimination or substitution

**First try to eliminate the hazard or use a different process** before considering risk controls that will help reduce the risk, like LEV, dilution ventilation, administrative controls and respiratory protection. Think about ways to modify the work process to eliminate or reduce the amount of hot work or fumes.

Consider the following:

- Use cold-joining techniques such as mechanical fasteners or adhesives.
- Redesign the job to use thinner-gauge material.
- Remove grease and all surface coatings before welding because paint and resin coatings may release toxic components when heated.
- Use a welding technique that creates less fumes and gases.

## 4.2 Engineering controls

When elimination or substitution is not possible, **engineering controls help reduce exposure to welding hazards by addressing the risks at their source.** Common examples include local exhaust ventilation (LEV) systems, which capture fumes and gases where they are generated, and dilution ventilation, which improves overall air quality by circulating and refreshing the air in the work area. These controls are often integrated into the workspace and can significantly reduce the concentration of contaminants in the air.

The following are controls that can be used for both indoor and outdoor welding. These controls apply to aluminum, mild steel and stainless-steel base metals. For welding involving alloys that contain beryllium or other highly toxic metals, consult a competent person.

### WHAT IS A COMPETENT PERSON?

The **OHS Act General Regulations** require many tasks to be performed by a **competent person**. A competent person means a person who is:

- **Qualified** because of that person's knowledge, training and experience to do the assigned work in a manner that will ensure the health and safety of the persons in the workplace, and
- **Knowledgeable** about the provisions of the OHS Act and the Regulations that apply to the assigned work, and about potential or actual danger to health or safety associated with the assigned work.

## ENGINEERING CONTROLS FOR COMMON WELDING PROCESSES

WELDING PROCESS	TYPE OF CONTROL
Tungsten inert gas (TIG)	<ul style="list-style-type: none"> <li>• Use LEV for higher-intensity activities. For lower-intensity activities, dilution ventilation may be adequate.</li> </ul>
Shielded metal arc (stick), metal inert gas (MIG), and flux-cored arc (FCAW) welding	<ul style="list-style-type: none"> <li>• Use a welding gun with on-torch extraction, if practicable. Otherwise, use one of the following:               <ul style="list-style-type: none"> <li>◦ An extracted welding booth</li> <li>◦ An extracted workbench</li> <li>◦ An LEV system with a movable capturing hood</li> </ul> </li> <li>• Make sure the work area has a clean fresh air supply to replace extracted air.</li> </ul>
Oxy-fuel cutting and other processes	<ul style="list-style-type: none"> <li>• Use a movable capturing hood.</li> <li>• Use dilution ventilation to minimize fumes in the area.</li> </ul>
Plasma arc cutting (fixed equipment)	<ul style="list-style-type: none"> <li>• Use a water table or downdraft table to capture fumes.</li> <li>• Use a good standard of dilution ventilation, such as the established engineering principles found in the American Conference of Governmental Industrial Hygienists (ACGIH) publication <b>Industrial Ventilation: A Manual of Recommended Practice for Design</b>.</li> </ul>
Air carbon arc gouging	<ul style="list-style-type: none"> <li>• Work in an enclosed booth with an inward airflow, if practicable.</li> <li>• Keep fume extraction as close as possible to where the fumes are generated.</li> <li>• Provide suitable respiratory protection.</li> </ul>

### 4.3 Examples of engineering controls

#### Local exhaust ventilation (LEV)

LEV is an engineering control that captures hazardous fumes and gases at the source and removes them from the workplace.

LEV systems are effective for controlling exposure to welding fumes if the systems are:

- Designed properly
- Appropriate for the situation
- Maintained regularly
- Monitored for performance

Workers should be trained in the use and maintenance of the LEV system. They should know how to operate and position it, as well as understand its limitations and effectiveness.

LEV systems should be designed by a qualified person, like an industrial ventilation engineer, who has assessed the ventilation needs of your workplace. The ACGIH recommends minimum duct velocities of 12.5 to 17.5 m/s (2500 to 3500 fpm) for welding fumes and capture velocities of 0.5 to 0.85 m/s (100 to 170 fpm).

### Capturing hoods

Capturing hoods are the most common type of LEV. With capturing hoods, the LEV system needs to generate enough airflow to draw in the fumes. The welding process happens outside the hood. There are several different types of capturing hoods for welding processes, such as on-torch capturing hoods, movable capturing hoods and extracted workbenches. The shape of the hood and its distance from the welding operation influence the hood's ability to draw in enough air to control exposures effectively.



On-torch capturing hoods are useful when welding larger workpieces that are too big to transport to a workbench.



Extraction workbenches are ideal for workpieces that can be transported to the workshop.

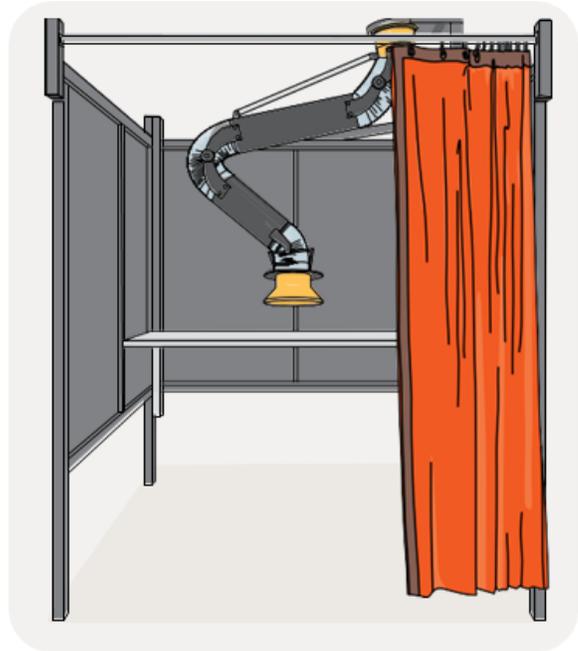


Movable capturing hoods are another option when working on larger workpieces.

## Welding benches and booths

Sometimes workpieces can be transported to a workshop and positioned on a welding bench or inside a booth. You can use an extraction bench or extraction booth that draws fumes away from the welder and toward the point of exhaust at the back of the bench or booth. The extraction hood doesn't need to be repositioned during welding to capture fumes.

Curtains on welding booths, shown on the right, with a movable capturing hood, help protect nearby workers against exposure to ultraviolet (UV) light or flash burns.



Consider the following guidelines:

- Make sure the fumes are drawn away from the welder through a series of extraction holes or slots in the bench or booth.
- Enclose as much of the bench or booth as reasonably possible to prevent cross-drafts and improve its ability to capture fumes.
- Position the workpiece on the bench or booth to capture fumes effectively. For example, use a turntable or custom jig to make sure that fumes are moved away from the welder.
- Keep the work surface of the bench or booth free from clutter so air movement won't be restricted.
- Make sure the workpiece or the area to be welded is entirely within the booth.

## On-torch LEV

Large and extra-large workpieces present different challenges because they are typically too big to transport to a workbench. For these workpieces, you can use on-torch extraction.

Welding torches with on-torch extraction come with an integrated vacuum hose. The hose diameter is normally about 25 mm (1 in.).

When set up and used correctly, on-torch extraction is the most effective fume control, with 70 to 98% efficiency. The efficiency varies depending on the welding method, the type of shielding gas, the material and the skill of the welder. If the required shielding gas makes on-torch extraction impractical, you can use LEV with a movable hood.

### Advantages of on-torch extraction

- The extraction is integrated with the welding gun.
- The extraction moves with the weld and is always close to the source.
- It requires low air volume, which reduces the amount of tempered air extracted from the shop. This makes it cost effective.
- The welder doesn't need to reposition the extraction hood to maintain good fume capture.

### Limitations of on-torch extraction

- The extraction unit can be bulky, so it's not always practical to have it close to the welding area when welding at heights.
- On-torch extraction is often effective for groove welding on a flat surface like downhand, horizontal, or vertical, but it's less effective for fillet welding or groove welding in the overhead position.

### **LEV with a movable capturing hood**

Use a movable capturing hood on a flexible extraction arm when other, more-effective LEV designs are not practical for large to extra-large workpieces. It's important to set up the LEV correctly so it:

- Captures the fumes away from the welder's breathing zone.
- Can be used without compromising the weld integrity.

### Consider the following guidelines for LEV systems with movable hoods:

- Select an appropriate hood design to maximize fume capture from your welding process. Consider the shape, size, and hood diameter, and whether you can use a flanged capture hood.
- Make sure ducting doesn't have any acute bends, kinks, holes, or cracks. Avoid long sections of flexible ducting.
- An optimal distance for capture is one duct diameter from the arc.
- Reposition the hood as often as necessary to maintain optimal fume capture.
- The recommended air volume is 600 to 1900 m<sup>3</sup>/h (400 to 1200 cfm) depending on the type of extraction arm or hood.
- The recommended capture velocities of between 0.5 to 0.85 m/s (100 to 170 fmp) aim to balance contaminant control and weld quality. Higher velocities can strip shielding gas and interfere with the weld.
- It's important to periodically check the effectiveness of an LEV system.
- In daily welding activities, a helpful best practice when using a movable capture hood is to **keep the hood face within 1 to 1.5 duct diameters from the weld zone**. This distance will achieve good contaminant control, assuming the system is operated within a recommended duct velocity.

### **Portable welding fume extractors with air cleaners**

You can use portable welding fume extractors fitted with air cleaners for some welding tasks when exhausting outside is not practicable or it's not a fixed workstation. These systems are acceptable if they effectively remove the fumes and filter the contaminants to minimize the effect of the exhausted air on the worker's overall exposure.

The equipment should have a series of filters, including spark arrestors, pleated filters, activated carbon filters and high efficiency particulate air (HEPA) filters. It should be equipped to monitor the differential pressures across the filters.

When selecting a unit, consider the welding process, base metals, consumables, and other process-related factors. A recirculating system should not be used at fixed welding stations where it is practicable to have a system that exhausts outdoors.

A preventive maintenance program is required to make sure that the extractor continues to work effectively. The program must include inspections and regular replacement of filters as per the manufacturer's instructions. Workers must wear respirators when changing the filter media.

As part of the risk assessment, the employer must make sure that worker exposure levels are evaluated once the system is installed and operational.

### **Selection, installation and maintenance**

When selecting a ventilation system, make sure it's user friendly and appropriate for the welding processes and the workplace. Selecting and installing an LEV system can be complicated. Poor design or installation of any one component will reduce the system's ability to remove fumes.

Hire a qualified person with experience designing systems to help you select the right system. A qualified person should also review any changes or additions to the system. For example, adding more hoods to a system can significantly impact its effectiveness.

LEV systems require regular checks and maintenance. Your LEV supplier should provide a user manual that describes how to use and maintain the system. As an employer, you should verify that the ventilation system is capable of working as intended. Follow the supplier's or installer's maintenance instructions and schedule.

The performance of any ventilation system will degrade over time. Establish ongoing degradation and trend monitoring for the ventilation system.

There are various methods for checking the effectiveness of an LEV system, including:

- Dust lamps
- Static pressure readings
- Pressure differential readings on filters
- Duct-system measurements
- Airflow indicators
- Smoke tubes

Employers must make sure workers are trained to complete routine checks of LEV systems before starting work. Any defects must be reported to a supervisor right away. Faults must be addressed promptly to keep the system functioning effectively.

#### CONSIDERATIONS FOR LEV SYSTEMS

- Weld in a dedicated area away from drafts and other workers. This prevents fumes from blowing away from the hood and into other workplace areas.
- Make sure LEV systems exhaust directly to the outdoors unless it is not practicable and portable extractors are used.
- Make sure the hood is the right design for the welding process and the types of fumes.
- Install an airflow indicator, such as a manometer, to check that the LEV is working properly.
- Make sure welders aren't positioned between the fumes and the hood.

#### **Dilution ventilation as an engineering control for indoor welding**

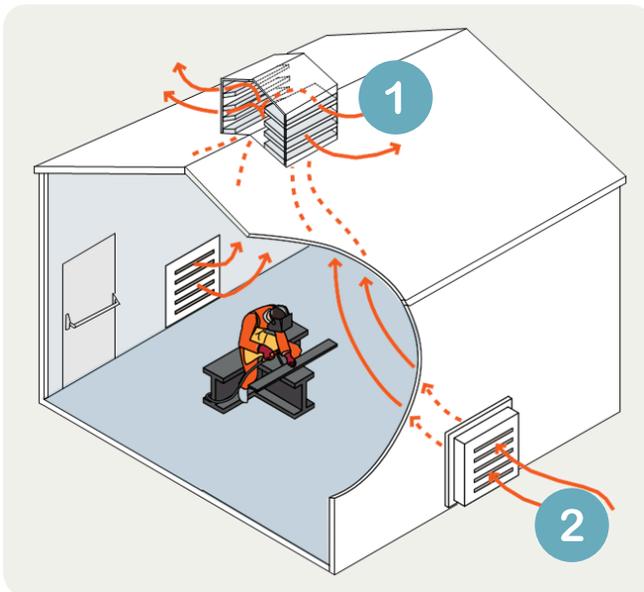
Where LEV is not sufficient or not practicable for fully removing welding fumes, using dilution ventilation as an additional engineering control can help prevent fume buildup. Natural dilution ventilation from open doors and windows is not reliable and generally doesn't provide enough air movement to disperse welding fumes.

Most welding workshops will need mechanical dilution ventilation, which uses fans mounted on the ceiling or high up on a wall. These fans extract the air from the room and draw in clean air to disperse airborne contaminants.

The amount of airflow needed to dilute welding fumes is much higher than the airflow used in LEV. The airflow will also depend on the rod diameter, the amount used, and the characteristics of the workspace. For example, in open areas, welding fumes can rise and disperse more easily. In enclosed areas, however, fumes can accumulate quickly without adequate ventilation.

Mechanical dilution ventilation systems work well for processes that produce small amounts of fumes, like low-intensity resistance spot welding and low-intensity TIG welding, in relatively large work areas with high ceilings. These systems also help control exposures for workers in adjacent areas.

Ventilation systems should be designed, installed and maintained according to established engineering principles. A useful guide is the ACGIH publication **Industrial Ventilation: A Manual of Recommended Practice for Design**.



**Dilution ventilation** is an additional control that helps prevent buildup of welding fumes and protects workers in adjacent areas.

- 1 Fume and hot air out via exhaust fans
- 2 Cool air flows in

#### 4.4 Welding in indoor and outdoor confined spaces

##### Welding outdoors

Welding outdoors is often done without controls due to a belief that natural ventilation will reduce fume levels sufficiently. However, outdoor welding is typically done with barriers in place or with the welder using their body to shield the weld. This reduces the effectiveness of natural ventilation and can lead to a buildup of fumes in the welder's breathing zone.

The current, low exposure limits, combined with the potentially serious health effects of exposure, mean that welding fumes and gases must be controlled to much lower levels than previously required. Except for infrequent and short-duration tasks, welding outdoors requires controls such as LEV, respiratory protection or both depending on the circumstances.

When welding within enclosures such as pipelines, an adequate LEV system must be in place to control exposures and to prevent the accumulation of shielding gases. Respiratory protection may also be required.

### **Welding in confined spaces**

Before starting any welding processes in a confined space, a competent person must assess and confirm that the space is safe for entry. Employers must follow the requirements outlined in Part 13 of the OHS Act General Regulations.

## **4.5 Administrative controls**

Administrative controls involve changing the way work is performed to reduce risk. These may include safe work procedures, training, scheduling, and workplace policies. For example, a common, required procedure is to clean welding surfaces of any coating, like solvent residue or paint, that could create a toxic exposure.

It's also important to control the levels of hazardous substances that can accumulate in the air and on surfaces. Some welding substances, like beryllium and chromium, can be absorbed through the skin or have direct effects on the skin because of irritation or sensitization. Hazardous substances like lead can also enter the body through accidental ingestion.

To minimize these risks employers should develop and implement decontamination procedures. This includes regularly cleaning areas where food and beverages are consumed, as well as other surfaces where skin exposure may happen. Employers must provide workers with access to personal hygiene facilities that are appropriate for the exposure.

## **4.6 Personal protective equipment (PPE)**

### **Respiratory protection**

Welders need to wear respirators unless occupational hygiene data shows that fume exposures are below the exposure limits. Good ventilation is one of the most important controls for welding fumes, but this control alone does not reduce levels of welding fumes to be below the exposure limits. A combination of good ventilation and respiratory protection is needed.

Respirator requirements are described in Part 45.17 of the OHS Act General Regulations. For additional information, please consult our guide for **Developing a Respiratory Protection Program** available at [wcb.pe.ca](http://wcb.pe.ca).

**Welders must wear respirators if both of the following are true:**

- The welding process in use generates a lot of fumes. For example, air carbon arc gouging, plasma arc cutting, FCA welding, or MIG welding for a significant duration of the shift.
- The size or shape of the workpiece means that LEV won't be enough to control the fumes for all the welds

Welders will also need respirators if the LEV system doesn't capture welding fumes consistently. For example, this can happen when using a movable capturing hood on a flexible arm for a large workpiece with long runs of welds.

Respirators may also be necessary for work in temporary work locations where the risk assessment indicates LEV is not reasonably practicable, like when working at heights.

In these situations, provide respirators to all workers in the area who are likely to be exposed to fumes, and make sure there is dilution ventilation to prevent fumes from lingering.



Half-face respirators may be necessary in locations where LEV isn't practicable or is only partially effective.

**Powered air-purifying respirators (PAPRs) with integrated welding visors**



PAPRs are available with an integrated welding visor to protect the skin and eyes from UV radiation and to provide a clear viewing window. This device allows a welder to keep the respirator in place when checking a weld. If a welder has to lift the visor to check a weld, they should wait until visible fumes have disappeared before doing so. PAPRs with welding visors let workers check welds without lifting the visor.

## 4.7 Respirator requirements

Most welding tasks will require the use of a respirator if engineering controls aren't enough to control exposures effectively.

Follow these requirements:

- Implement a written respirator program if respirators are required to protect workers.
- Make sure workers are fit tested if they are using respirators with a tight-fitting face seal.
- Make sure workers with tight-fitting respirators are clean shaven where the respirator seals to the face.
- Train workers on how to use and maintain their respirators and on the limitations of the respirators.

There may be some situations where, in addition to a respirator with a P100 filter, the welder may need a gas and vapour cartridge that is appropriate for the hazard.

Where workers must perform welding tasks for more than one hour per day, consider providing PAPRs. Workers are more likely to use PAPRs consistently because they're more comfortable and most models allow for the presence of facial hair.

**For more information, see our guide for  
Developing a Respiratory Protection Program at [wcb.pe.ca](http://wcb.pe.ca)**

# CHAPTER 5 - COMMUNICATING WITH WORKERS

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## 5.0 Making sure workers are informed, trained and supported

Employers are responsible for making sure workers are informed about the health hazards associated with welding fumes and gases. This includes providing orientation and ongoing training on the risks, control measures, and safe work practices. Managers and supervisors must also be included in health and safety training to support a consistent and informed approach across the workplace.

### 5.1 Education and training

Make sure workers receive education and training on the following:

- Workplace health and safety responsibilities of employers, supervisors, and workers.
- How to recognize welding fume hazards.
- Health effects of welding fumes.
- How to report welding fume hazards to a supervisor or the employer.
- Safe work practices and procedures in place to minimize exposure to welding fumes.
- How to use LEV, and how to make sure it's functioning properly.
- How to position themselves and the workpiece when welding.
- When respirators are required and how to use them.
- How to inspect, maintain, and store respirators.
- What is included in the workplace risk assessments and control plans.

### 5.2 Safe work procedures

Written safe work procedures explain to workers in reasonable detail the steps they need to follow to perform their work safely. Employers must provide workers with instruction, training, and supervision to make sure they understand the procedures and are able to perform their tasks safely. Employers must also provide effective supervision to make sure that workers are all following safe work practices and procedures.

### 5.3 Documentation

It's important to document what you find during inspections, risk assessments and air monitoring. All air monitoring test results must be made available to workers upon request, as required under Section 27(6) of the OHS Act. You should also keep training records and have a written exposure control plan (ECP). Your documentation doesn't need to be complicated, but it should have enough information to help you communicate and manage risks in your workplace. These documents will help demonstrate how you are implementing your health and safety policies, procedures and practices. They will also provide proof of any enforcement actions you have taken and demonstrate that appropriate checks and reviews are in place.

**Visit our website [wcb.pe.ca](http://wcb.pe.ca) for more information and additional resources.**

# CHAPTER 6 - MONITORING AND UPDATING RISK CONTROLS

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## 6.0 Making sure controls remain effective over time

Protecting workers from harm involves ongoing effort. Employers need to monitor the effectiveness of the risk controls they have in place and improve those that are inadequate to control risks.

Do the following:

- Conduct regular safety inspections so you can monitor the effectiveness of existing controls and identify new or changing hazards and risks.
- Consult with your safety committee or representative, as applicable.
- Review your welding risk assessments and controls at least once a year, in consultation with the safety committee or representative, as applicable. Update as necessary.
- Update your risk assessments whenever you introduce new equipment, materials or work processes.
- Address any health and safety concerns as soon as possible.

## 6.1 Controlling exposure to welding fumes and gases

In PEI, employers must take steps to identify, assess, and control worker exposure to welding fumes and gases in accordance with the OHS Act General Regulations.

An employer must be able to demonstrate that appropriate measures have been implemented to minimize worker exposure to hazardous substances. As with any risk assessment, employers should document both their assessment and their control plans.

A risk assessment and control plan for welding fumes may include, but is not limited to:

- A statement of purpose and responsibilities.
- The chemicals which workers are exposed to.
- The exposure levels: low, moderate, or high.
- Any exposure monitoring results, if available.
- The risk controls that will be used to minimize exposures like ventilation, respirators, administrative, etc.
- Documentation of education and training.
- Written work procedures,
- Hygiene facilities and decontamination procedures.

## 6.2 Evaluating exposures

As an employer, you need to periodically evaluate worker exposures to welding fumes and gases. Evaluating exposures can help you determine how effective your risk controls are. The exposure evaluation must be done by an Occupational Hygienist or another qualified person. The evaluation may involve industrial hygiene sampling at your work site, whereby the levels of fumes and gases are compared to the relevant PEI exposure limits. This information is used to make judgments about worker exposures and the adequacy of workplace controls. An exposure limit is an upper limit for the acceptable concentration of a hazardous substance in the air of a workplace. If the results show that your current controls are not working effectively, the qualified person can help identify appropriate controls for your workplace. Employers must make sure that the results of the exposure evaluation are provided to workers.

## 6.3 Health monitoring

Health monitoring may be necessary for substances such as lead and cadmium, which are associated with some welding activities. Health monitoring helps protect workers from developing occupational disease by detecting biological indicators or adverse health effects early on.

Workers who are regularly exposed to welding or cutting fumes should tell their family doctors so records can be kept. As a worker, you may want to discuss with your doctor the potential health effects of welding fume exposures.

Workers should report any signs or symptoms of welding fume exposure to their employer for tracking and investigation purposes.

**Visit our website [wcb.pe.ca](http://wcb.pe.ca) for more information and additional resources.**

# CHAPTER 7 - FOR MORE INFORMATION

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## 7.0 Regulatory references

In the OHS Act General Regulations, refer to the following content:

- Part 11, Ventilation
- Part 13, Confined Space
- Part 37, Welding
- Part 45.17, Respiratory Protection

## 7.1 WCB PEI resources

- Guide - Developing a Respiratory Protection Program
- Prevention Update - Exposure to Hexavalent Chromium from Welding
- Prevention Update - Emergency Eyewash Stations and Shower Equipment
- Prevention Update - Fire retardant clothing requirements for welders and cutters
- Hazard Alert - Oxygen Tank Valves
- OHS App - Occupational Carcinogens
- OHS App - Welding

## 7.2 Other resources

- Welding Gases & Fumes (WorkSafeBC)
- Welding Fume Exposure (WorkSafeBC)
- Breathe Safer: How to Use Respirators Safely and Start a Respirator Program (WorkSafeBC)
- CSA Standard W117.2:19 Safety in Welding, Cutting, and Allied Processes (CSA Group)
- Welding — Overview of Types and Hazards (Canadian Centre for Occupational Health and Safety) Welding Health and Safety: A Field Guide for OEHS Professionals, 2<sup>nd</sup> Edition. (AIHA Harris, M, and M. Phibbs)

**Visit our website [wcb.pe.ca](http://wcb.pe.ca) for more information and additional resources.**

## Appendix A - Sources and health effects of welding fumes

FUME	SOURCES	HEALTH EFFECTS
<b>ALUMINUM</b>	Aluminum component of some alloys, such as Inconel, copper, zinc, steel, magnesium, brass, and filler materials	Lower respiratory tract irritation, pneumoconiosis, neurotoxicity
<b>BERYLLIUM</b>	Hardening agent found in copper, magnesium, aluminum alloys, and electrical contacts	Beryllium sensitization, chronic lung disease, cancer  Exposure may happen by skin route
<b>CADMIUM OXIDES</b> 	Stainless steel containing cadmium or plated materials, zinc alloy	Lung cancer, metal fume fever, kidney damage
<b>CHROMIUM</b> 	Most stainless- steel and high-alloy materials, welding rods  Some electroplated metals  Hexavalent chromium is formed during welding	Lung and sino-nasal cancer; asthma; respiratory tract and skin irritation and sensitization  Health effects vary with form of chromium  Exposure may happen by skin route
<b>COPPER</b>	Alloys such as Monel, brass, bronze, some welding rods  Coating on filler fire, sheaths on air carbon arc gouging electrodes, non-ferrous alloys	Eye, skin, nose, and throat irritation; metal fume fever; gastrointestinal distress

FUME	SOURCES	HEALTH EFFECTS
<b>FLUORIDES</b>	Common electrode coating and flux material for both low- and high-alloy steels	Bone and joint damage, fluorosis  Eye, skin, and respiratory tract irritation  Chronic effects may include gastrointestinal symptoms, fluid in lungs, and kidney dysfunction
<b>IRON OXIDES</b>	Major contaminant in all iron or steel welding processes	Pulmonary siderosis (lung disease); nose and lung irritation
<b>LEAD</b>	Solder, brass, and bronze alloys  Primers and other coatings on base metals	Blood effects; central and peripheral nervous system impairment; effects on kidneys and digestive system; adverse reproductive effects  May cause cancer  Health effects vary with form. See chromium.
<b>MANGANESE</b>	Most welding processes, especially high-tensile steels	Central nervous system impairment, metal fume fever, adverse reproductive effects, manganese poisoning
<b>MOLYBDENUM</b>	Steel alloys, iron, stainless steel, nickel alloys	Respiratory tract irritation



FUME	SOURCES	HEALTH EFFECTS
<b>NICKEL</b> 	Stainless steel, Inconel, Monel, Hastelloy and other high-alloy materials, welding rods, and plated steel	Nasal and lung cancer, pneumoconiosis, dermatitis, asthma-like lung disease, renal dysfunction, respiratory tract irritation  Health effects vary with form of nickel
<b>VANADIUM</b> 	Some steel alloys, iron, stainless steel, nickel alloys	Upper and lower respiratory tract and eye irritation  May cause cancer
<b>ZINC</b>	Galvanized and painted metal	Metal fume fever

## Appendix B - Sources and health effects of welding gases

GAS	SOURCES	HEALTH EFFECTS
<b>CARBON MONOXIDE</b>	Formed in the welding arc	Adverse effects on neurobehavioural system, cardiovascular system, and exercise capability, as well as fetuses  Headache, dizziness, unconsciousness
<b>HYDROGEN FLUORIDE</b>	Decomposition of rod coatings	Pulmonary inflammation; lung damage; eye, skin, and respiratory tract irritation; fluorosis  Exposure may happen through skin
<b>NITROGEN OXIDES</b>	Formed in the welding arc	Lower and upper respiratory tract and eye irritation, cyanosis, hypoxia, pulmonary edema, lung disease (emphysema)
<b>OXYGEN DEFICIENCY</b>	Welding in confined spaces  Air displacement by shielding gas	Dizziness, mental confusion, asphyxiation
<b>OZONE</b>	Formed in the welding arc, especially during plasma arc, MIG, and TIG processes	Lung function impairment, pulmonary edema, hemorrhaging  Headaches; dryness of mucous membranes and throat

## Appendix C - Sources and health effects of organic vapours and other gases

GAS/VAPOUR	SOURCES	HEALTH EFFECTS
<b>ALDEHYDES, LIKE FORMALDEHYDE</b> 	Metal coatings with binders and pigments  Degreasing solvents	With formaldehyde, irritation of eyes and respiratory tract; upper respiratory tract cancer, sensitization
<b>DIISOCYANATES</b>	Metal with polyurethane paint	Lung function impairment; respiratory tract sensitization; skin sensitization; eye, nose, and throat irritation  Exposure may happen through skin  Health effects depend on type of diisocyanate
<b>PHOSGENE</b>	Metal with residual chlorinated degreasing solvents  Formed by reaction of the solvent and welding radiation	Respiratory tract irritation, pulmonary edema, lung congestion, emphysema  Symptoms may be delayed
<b>PHOSPHINE</b>	Metal coated with rust inhibitors	Respiratory tract irritation, pulmonary edema, kidney damage

