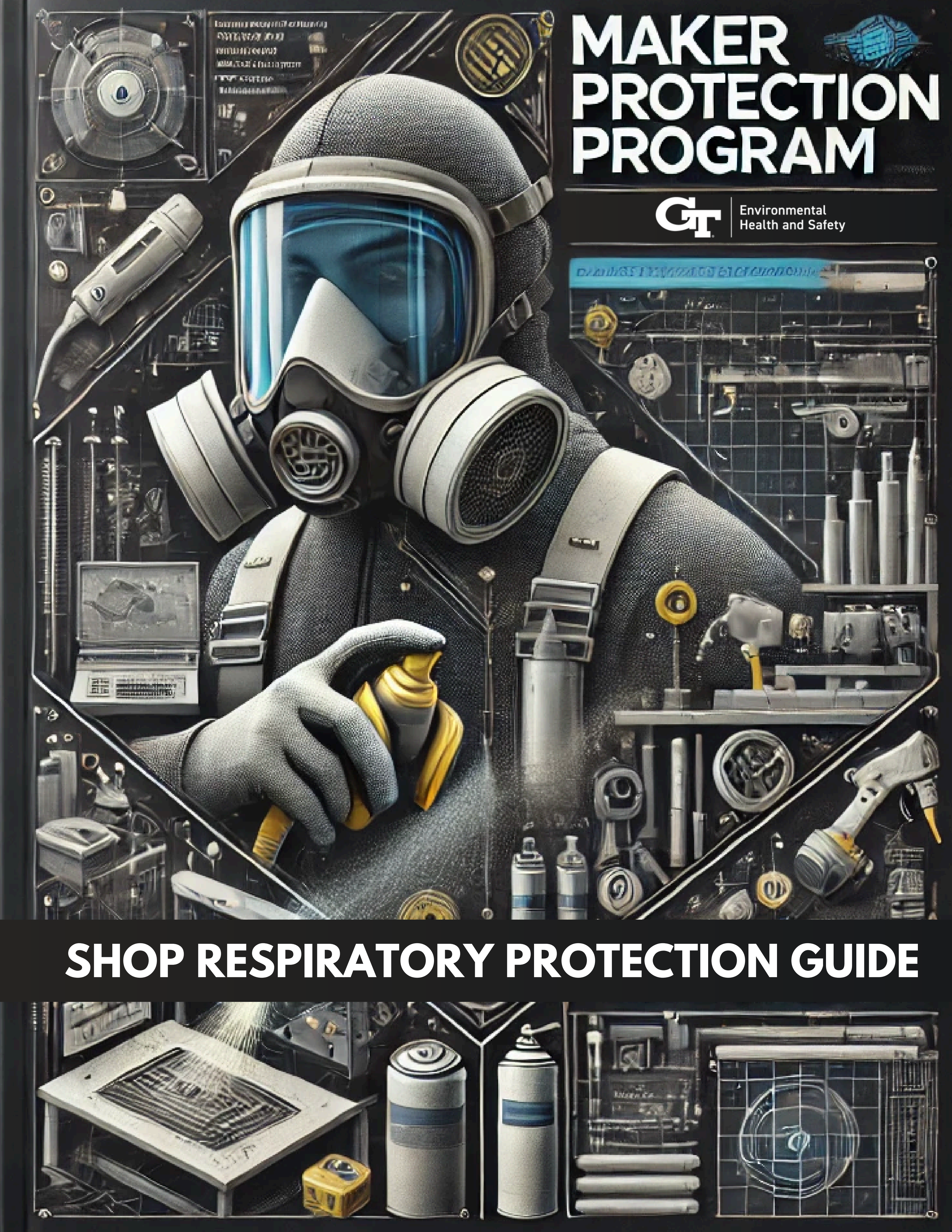
MAKER PROTECTION PROGRAM

Environmental Health and Safety



SHOP RESPIRATORY PROTECTION GUIDE

RIGHT FIT

MAKER PROTECTION

PROGRAM HANDBOOK

Environmental Health and Safety

Welcome to the Georgia Tech Respiratory Protection Shop Guide

The Purpose of This Guide

The Maker's Protection Program: Shop Respiratory Protection Guide aims to provide makerspace users with essential knowledge and practical strategies to ensure their safety, particularly regarding respiratory protection. This guide addresses the unique hazards encountered in makerspaces, such as dust, fumes, and vapors, and offers tailored recommendations for minimizing exposure during common tasks.

By promoting best practices, proper equipment use, and a culture of safety, this guide empowers users to prioritize their health while fostering innovation and creativity in a safe and supportive environment.

By The GT Laboratory + Chemical Safety Team

Table of Contents

Table of Contents

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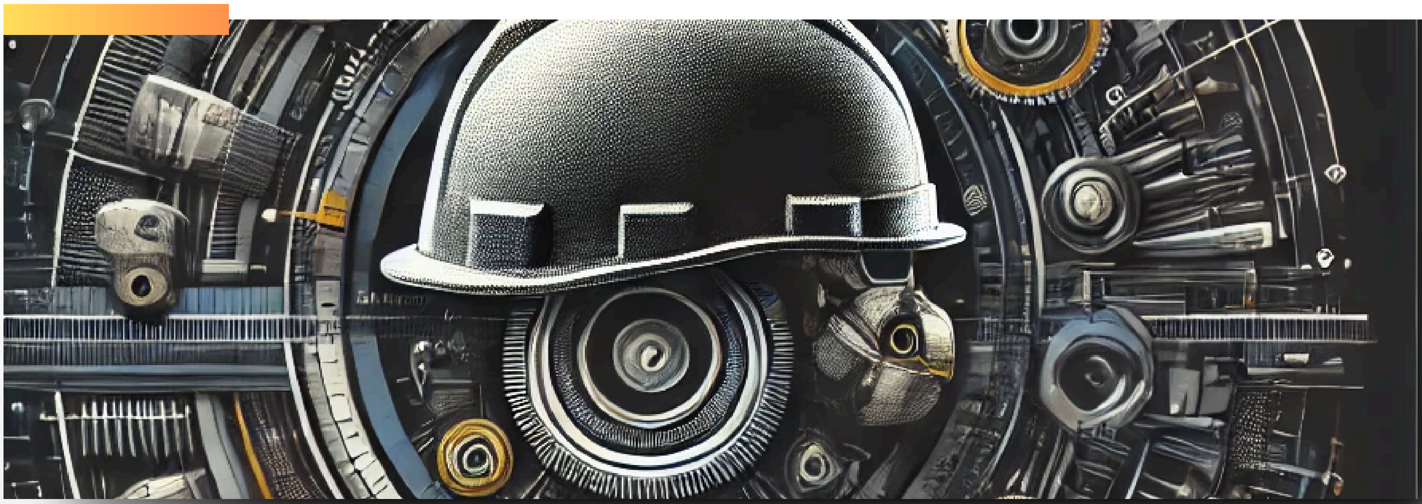
Executive Summary



The **Maker's Protection Program: Shop Respiratory Protection Guide** is designed to ensure safety and health in makerspaces by providing clear guidelines for respiratory protection and overall safety practices. Makerspaces expose users to hazards like dust, fumes, and vapors from tasks such as sanding, cutting, painting, welding, and chemical work. This guide addresses these risks, equipping users with the tools and knowledge needed to work safely.

This guide outlines common hazards and provides tailored respiratory protection recommendations for specific tasks. Each section highlights the risks, recommended respirators, and safety tips for minimizing exposure. It also covers respirator selection, use, and maintenance, emphasizing the importance of fit testing and proper care.

Additional topics include ventilation and environmental controls, emergency preparedness, and fostering a culture of safety. Quick reference charts, checklists, and resources make the guide practical and easy to use.

By following the recommendations in this guide, makerspace users can protect themselves from respiratory hazards and focus on their creativity while maintaining a safe work environment.

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INTRODUCTION

Welcome to the Maker's Protection Program: A Practical Guide!

At the heart of every makerspace is creativity, innovation, and hands-on learning. Whether you're crafting, building, or experimenting, safety is key to ensuring that your work is both productive and enjoyable. This guide is here to help you navigate the unique challenges of makerspaces, particularly when it comes to respiratory protection and overall safety practices.

Inside, you'll find clear, actionable advice tailored to the tools and materials you use every day. From sanding and cutting to welding and working with resins, this handbook provides the knowledge and resources you need to protect your health while pursuing your projects.

Your safety is our priority. By using this guide, you’re taking an important step toward creating not just amazing things but also a safer, healthier environment for yourself and others. Thank you for making safety an integral part of your creativity.

Program Overview

The Georgia Tech RightFit Maker Protection Program is a specialized initiative designed to ensure the health and safety of students engaging in creative and technical activities within the institute's maker spaces and workshops. This program, a branch of the overarching RightFit initiative, emphasizes the critical role of respiratory safety in driving innovative excellence.

The Maker Protection Program provides comprehensive respiratory protection tailored to the unique needs of students working with various materials and equipment. From welding and sanding to painting and chemical use, this program addresses all potential respiratory hazards to create a secure environment where innovation can flourish.

Purpose + Goals of the Program

The Maker's Protection Program was created to promote safety and health in makerspaces while enabling creativity and innovation. Makerspaces are dynamic environments where individuals work with a variety of tools, materials, and processes, each with unique risks.

The goal of this program is to equip users with the knowledge and resources needed to recognize and mitigate hazards, with a particular focus on respiratory protection. By fostering a culture of safety, we aim to create a workspace where everyone can confidently pursue their projects while prioritizing their well-being.

Scope of the Handbook

This handbook focuses on providing respiratory protection guidelines for specific makerspace tasks such as sanding, cutting, painting, welding, and working with resins and epoxies.

While respiratory safety is the primary focus, the guide also addresses broader safety practices, including proper ventilation, emergency preparedness, and the integration of respiratory protection with other personal protective equipment (PPE). This comprehensive approach ensures users can effectively manage hazards while maintaining a productive and safe environment.

Why Respiratory Protection Matters

Respiratory hazards are common in makerspaces and can significantly impact health if not properly addressed. Dust from sanding, fumes from welding, and vapors from chemical processes like painting or resin work can cause immediate respiratory irritation and, over time, lead to chronic health conditions.

Using appropriate respiratory protection reduces exposure to these hazards, protecting the lungs and overall health. This handbook is designed to help users identify risks and select the right protective equipment to ensure safety during all makerspace activities.

Audience

This guide is tailored for all makerspace users, including students, staff, and professionals who engage in hands-on projects. Whether you’re an experienced maker or a newcomer, the content is designed to be accessible, practical, and relevant to your needs.

The guidance provided applies across various disciplines, empowering everyone to make safety a foundational part of their creative process.

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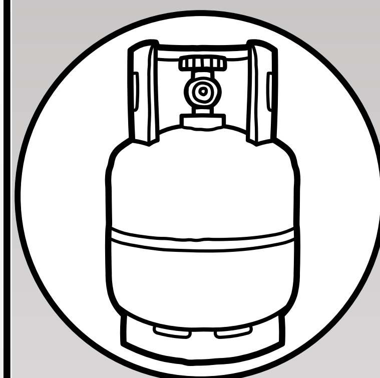
IMPORTANCE OF RESPIRATORY PROTECTION IN MAKERSPACES

Makerspace Hazards Overview

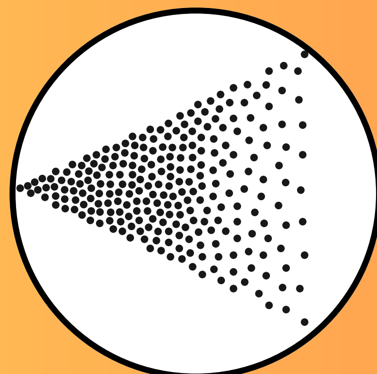
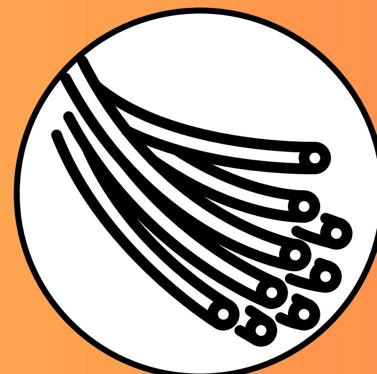
Makerspaces are vibrant hubs for creativity and innovation, but the materials and processes used can generate a range of hazards that pose risks to your respiratory health. Understanding these hazards is the first step in protecting yourself and ensuring a safe work environment.

This section provides an overview of the most common respiratory hazards encountered in makerspaces and the potential health risks they pose.

Gaseous

GASES	VAPORS
	
Gases are invisible hazards that can come from chemical reactions, combustion, or specific materials used in makerspaces.	**Vapors are airborne molecules released from liquids, such as solvents and adhesives, during use or drying.**
Examples: Carbon dioxide (CO_2), carbon monoxide (CO), chlorine, and hydrogen sulfide. **Sources: Poorly ventilated areas, combustion engines, or chemical use.**	**Examples: Methylene chloride, toluene, and VOCs from paints and resins.** **Sources: Spray painting, solvent-based adhesives, cleaning agents, and resin application.**

Particulate Matter

DUST	FUMES	MISTS	FIBERS
			
Dust consists of fine solid particles generated by mechanical processes.	Fumes are tiny solid particles formed when materials are heated to a gaseous state and then cool and condense in the air.	Mists are liquid droplets suspended in the air, often formed during spray applications or machining.	Fibers are elongated particles that can become airborne during cutting or handling specific materials.
Examples: Wood dust, metal dust, silica, and composite dust. Sources: Sanding, cutting, grinding, and other fabrication activities.	Examples: Metal fumes from welding or soldering, including lead, zinc, and iron fumes. Sources: Welding, smelting, soldering, and high-temperature processes.	Examples: Paint mists, oil mists, and chemical sprays. Sources: Spray painting, cutting fluids, and other liquid-based operations.	Examples: Fiberglass and carbon fibers. Sources: Cutting or sanding composite materials and fiberglass insulation.

Respiratory Risks

GASES

Risks: Gases can cause respiratory irritation, poisoning, or suffocation, depending on their concentration and type.

VAPORS

Risks: Inhalation of vapors can irritate the respiratory system and, with prolonged exposure, damage the central nervous system.

DUST

Risks: Dust particles can irritate the respiratory system and cause long-term health issues, such as asthma or silicosis, if inhaled regularly.

FUMES

Risks: Exposure to fumes can lead to respiratory irritation, metal fume fever, and chronic respiratory conditions.

MISTS

Risks: Mists can settle in the respiratory tract, causing irritation or chemical exposure.

FIBERS

Risks: Fibers can irritate the respiratory system and may cause long-term health issues with repeated exposure.

Health Risks

The hazards above can lead to both short-term and long-term health effects, including:

- Short-Term Effects: Irritation of the eyes, nose, and throat; dizziness; nausea; and headaches.
- Long-Term Effects: Chronic respiratory diseases, such as asthma, bronchitis, or silicosis, and in severe cases, permanent lung damage or systemic health problems.

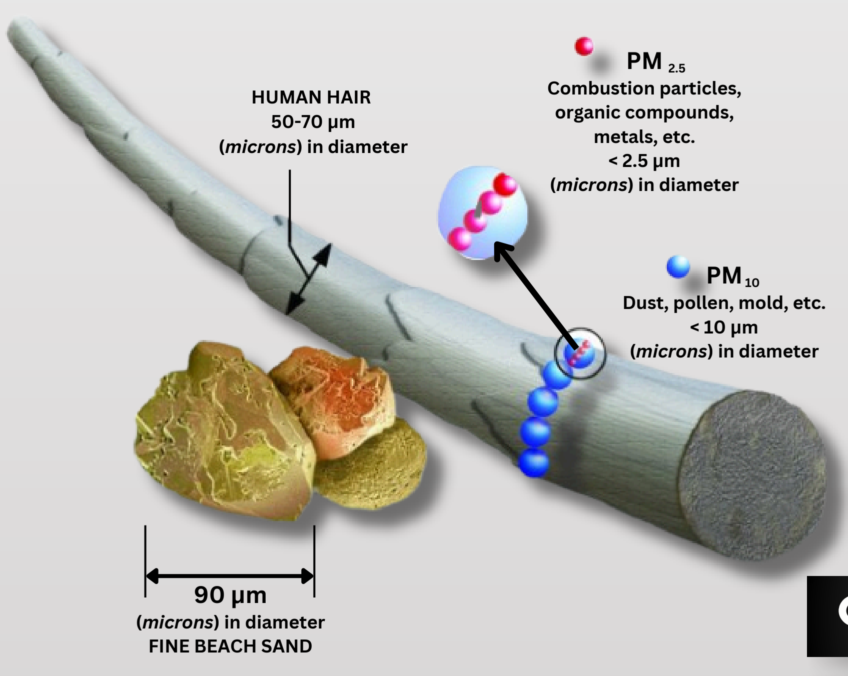
Importance of Respiratory Protection in Makerspaces

Respiratory protection is a critical component of safety in makerspaces, where users are often exposed to harmful airborne contaminants. These hazards can include dust, fumes, gases, vapors, and fibers generated during various tasks. Without proper protection, these contaminants pose significant health risks, ranging from respiratory irritation and allergic reactions to chronic illnesses and life-threatening conditions.

The significance of respiratory protection in makerspaces is highlighted by several key factors:

- **Diverse Hazards**: Makerspaces involve a wide range of processes, each with its own set of airborne risks. From sanding and cutting to welding and chemical work, the potential for exposure is high.
- **Health Impacts**: Exposure to airborne contaminants can lead to both short-term issues, such as throat irritation or dizziness, and long-term conditions, including asthma, silicosis, or chemical sensitization.
- **Safety Culture**: Emphasizing respiratory protection encourages a proactive safety culture, empowering users to prioritize their well-being and that of others.

By understanding the risks and taking appropriate precautions, makerspace users can confidently work in these creative environments while safeguarding their respiratory health.



Courtesy of the EPA

General Safety Principles

To ensure a safe and healthy environment in makerspaces, it is essential to adopt proactive measures that minimize exposure to respiratory hazards. Following these general safety principles will help reduce risks and create a culture of safety for all users.

Use the Appropriate Respiratory Protection

Wearing the correct respirator for the task is critical to protecting yourself from airborne hazards. Different tasks and materials require different types of respirators:

- Particulate Filters (N95, P100): Protect against dust, fumes, and fibers.
- Organic Vapor Cartridges: Filter out harmful vapors from solvents, paints, and adhesives.
- Combination Respirators: Provide protection against multiple hazards when tasks involve mixed exposures.
- Ensure your respirator fits correctly through proper fit testing and regular checks.

Ensure Adequate Ventilation

Good ventilation is a cornerstone of hazard control in makerspaces. It helps dilute and remove airborne contaminants before they reach your breathing zone:

- Local Exhaust Ventilation (LEV): Use fume hoods or extraction systems directly at the source of the hazard, especially during welding, soldering, or spray painting.
- General Ventilation: Maintain airflow in the workspace to prevent accumulation of hazardous gases, vapors, and dust.
- Natural Ventilation: Open windows and doors where mechanical systems are unavailable, but note that this is less effective than purpose-built systems.

Follow Proper Work Practices

Adopting correct techniques and processes can significantly reduce the generation of hazardous airborne particles:

- Wet Methods: Use water or a wetting agent to suppress dust during sanding or cutting tasks.
- Enclosed Systems: Perform hazardous tasks inside enclosures or booths to contain emissions.
- Tool Maintenance: Ensure tools are in good working condition to minimize unnecessary dust or vapor production.

Keep Your Workspace Clean

A clean workspace helps prevent the accumulation of hazardous materials:

- Regular Cleaning: Use vacuum systems with HEPA filters for cleaning dust and debris instead of sweeping, which can resuspend particles into the air.
- Proper Waste Disposal: Dispose of hazardous waste, such as used filters, solvents, and contaminated materials, according to your organization’s safety guidelines.
- Avoid Cross-Contamination: Clean tools and surfaces between tasks to prevent the spread of hazardous particles or residues.

Stay Informed and Prepared

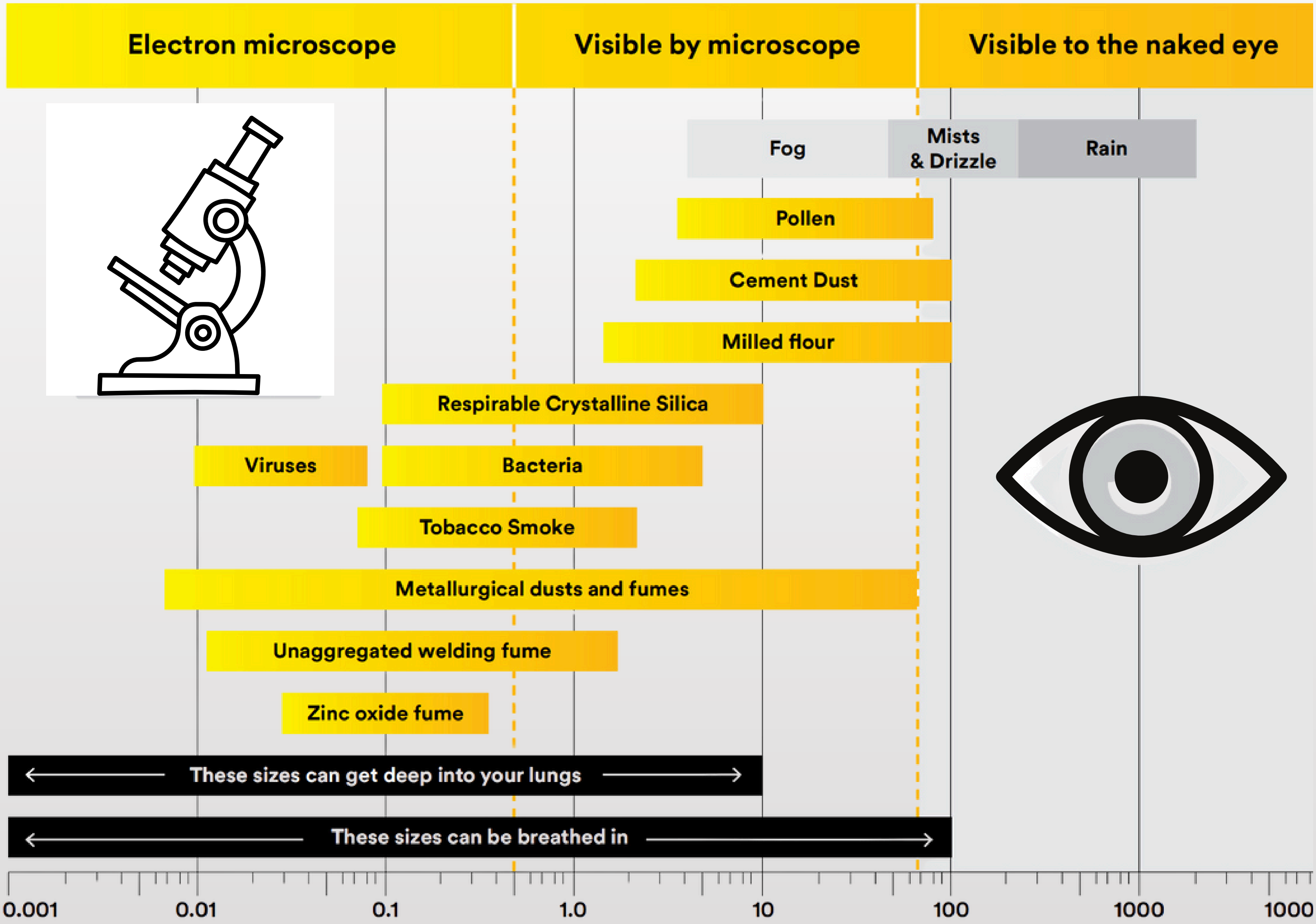
Knowledge is one of your best tools for safety:

- Read Material Safety Data Sheets (MSDS): Understand the hazards of materials you’re working with and the necessary precautions.
- Training: Participate in training sessions provided by your organization to stay updated on safety protocols.
- Emergency Procedures: Be familiar with the steps to take in case of overexposure, equipment failure, or other emergencies.

Examples of Particulate Sizes

- Generally, particles of 100 microns or less can all be breathed in; they are called inhalable particle sizes.

- Particles of 10 microns or less, called respirable particles, can get deep into the airways of our lungs and can reach the delicate gas exchange region and may cause serious damage.



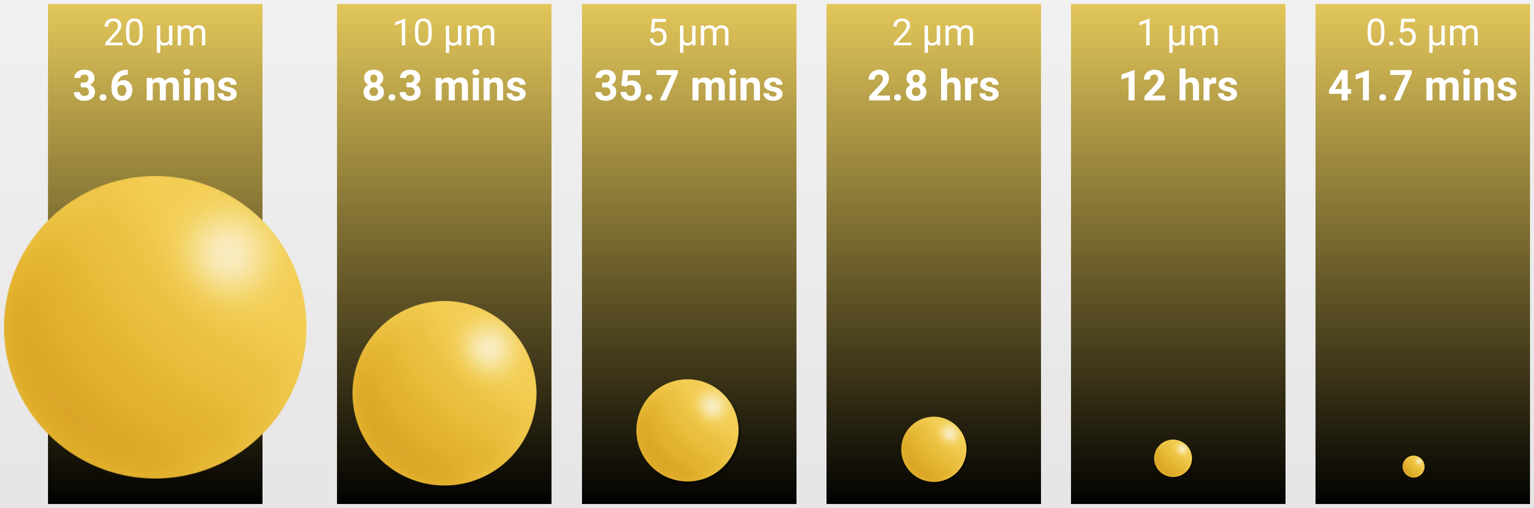
Courtesy of 3M

How Long Can Particles Stay in the Air

It is important to exercise caution and avoid removing a respirator too soon after engaging in particle-generating activities such as spraying, cutting, grinding, or welding. Failure to do so can put users at significant risk of inhaling harmful particles or fumes that may cause respiratory problems or other health issues. It is recommended to wait until the area is well-ventilated and any airborne particles have settled before removing the respirator to ensure maximum safety.

A dust particule's size and the stillness of the air can determine how long it may stay in the air.

1000 µm (micron) = 1 millimetre



Estimated settling rates for different sized mist droplets...from a height of 1.5 meters in still air

If the air is turbulent these droplets can remain airborne far longer. These small droplets become invisible as they disperse in the air. Dry particles like wood dust and cement dust of similar sizes behave in a very similar way.

^ Source: HSE data extracted from "Air pollution its origin & control" by Kenneth Wark & Cecil F Warner

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Environmental
Health and Safety

Shop Guide

TASK-SPECIFIC RESPIRATOR PROTECTION

Types of Respiratory Protection Devices

Respiratory protection devices are essential tools designed to safeguard individuals from inhaling hazardous substances, particulates, or infectious agents present in the air. These devices vary in design, level of protection, and suitability for different environments. Here's a detailed section on various types of respiratory protection devices.

FILTERING FACEPIECE RESPIRATORS:

- **Example:** N95 or P100 respirators.
- **Use For:** Dust, fibers, and non-oily particulates, such as wood dust or fiberglass.
- **Limitations**: Not effective for vapors or gases.

HALF-FACE RESPIRATORS:

- **Example:** Elastomeric half-mask respirators.
- **Use For:**
  - ***P100 Filters***: Dust, fumes, and fibers.
  - ***Organic Vapor Cartridges***: Vapors from resins, paints, and solvents.
- **Limitations:** Does not provide eye protection.

From the simplicity of N95s to the comprehensive coverage of full-face respirators, each type holds the key to unlocking a safer breath in its designated realm.

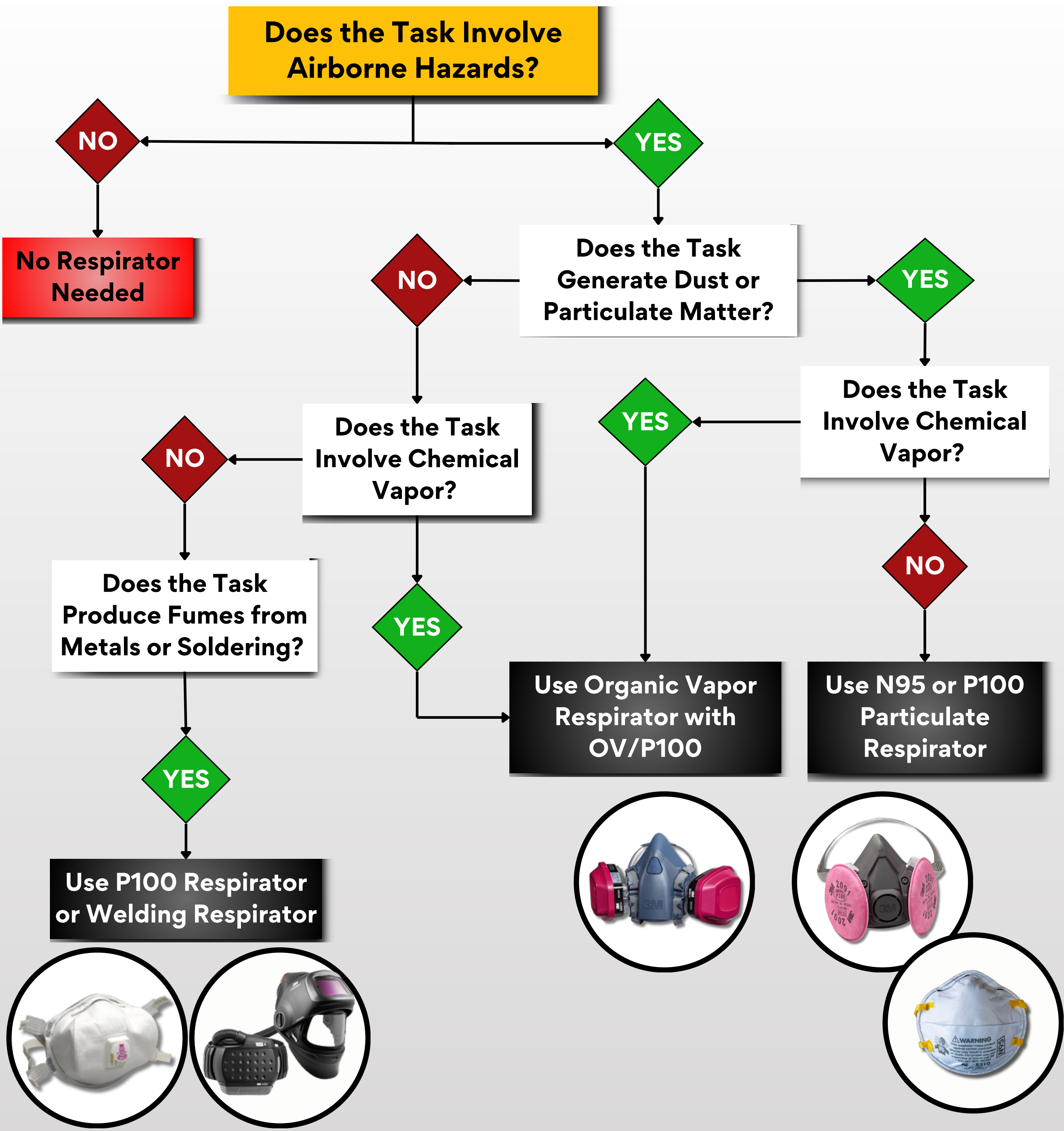
FULL-FACE RESPIRATORS:

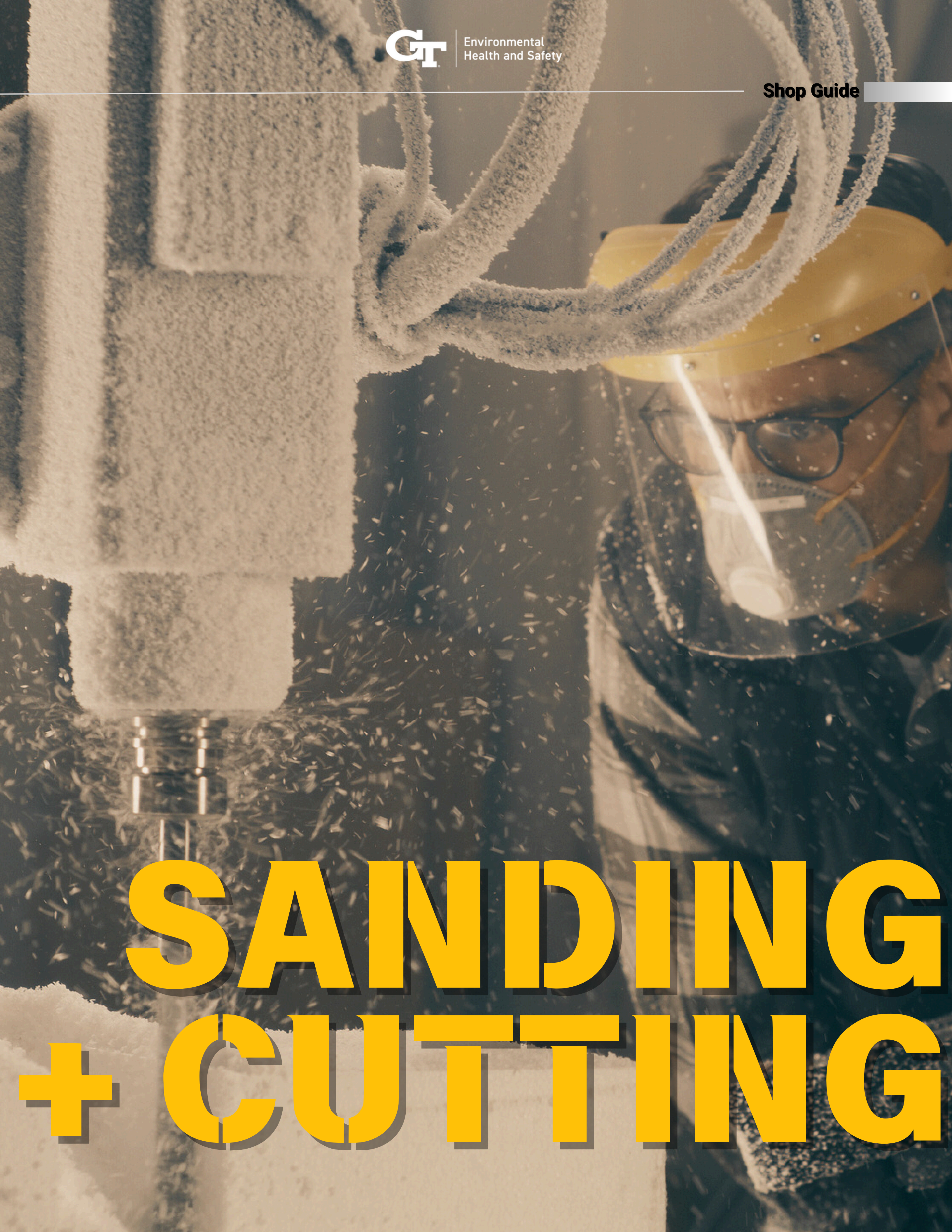
- **Use For:** Tasks involving both respiratory and eye hazards, such as spray casting or working with strong chemicals like isocyanates.
- **Features:** Provides integrated eye protection and a higher level of protection for the face.

POWERED AIR-PURIFYING RESPIRATORS (PAPRS):

- **Use For:** High-exposure environments or users requiring additional comfort over long periods.
- **Features:** A battery-powered fan draws air through filters, reducing breathing resistance.

Respirator Decision Tree for Shop Tasks





SANDING + CUTTING

Sanding and Cutting (Wood, Metal, Composites, and Foam)

Sanding and cutting materials such as wood, metal, composites, and foam generate fine dust and particles that are easily inhaled. Wood dust, for example, can cause respiratory irritation, allergies, or even asthma with prolonged exposure. Metal particles pose their own risks, potentially causing lung issues over time. Cutting composites and foam produces tiny fibers and dust that may irritate the respiratory tract.

	WOOD DUST	METAL DUST	COMPOSITES & FOAM DUST
Hazards	Can cause respiratory irritation and, in some cases, allergic reactions or asthma.	May lead to long-term lung issues, such as pneumoconiosis.	Fine particles and fibers can irritate the respiratory tract.
Recommended Respiratory Protection	N95 filtering facepiece respirators (FFR) are effective for dust particles. 	A half-mask respirator with P100 filters offers better protection against finer particles. 	**Composites**: A half-mask respirator with P100 filters offers better protection against finer particles. **Foam**: N95 filtering facepiece respirators (FFR) are effective for dust particles.  

Additional Safety Tips

- Use tools with dust collection systems.
- Wet-sand or use other methods to reduce airborne particles.
- Clean the workspace with HEPA-filtered vacuums.

Environmental Health and Safety

Shop Guide

RESIN + EPOXY

Resin and Epoxy Work

Working with resins and epoxies releases volatile organic compounds (VOCs) into the air. VOCs can cause irritation of the eyes, nose, and throat, and high exposure may lead to central nervous system effects such as dizziness and headaches.

	RESINS AND EXPOXIES
Hazards	Volatile Organic Compounds (VOCs) released during application and curing can irritate the respiratory system and cause dizziness or headaches.
Recommended Respiratory Protection	Use a half-mask respirator with organic vapor cartridges. Add a P100 filter when sanding cured resin to capture fine particulates

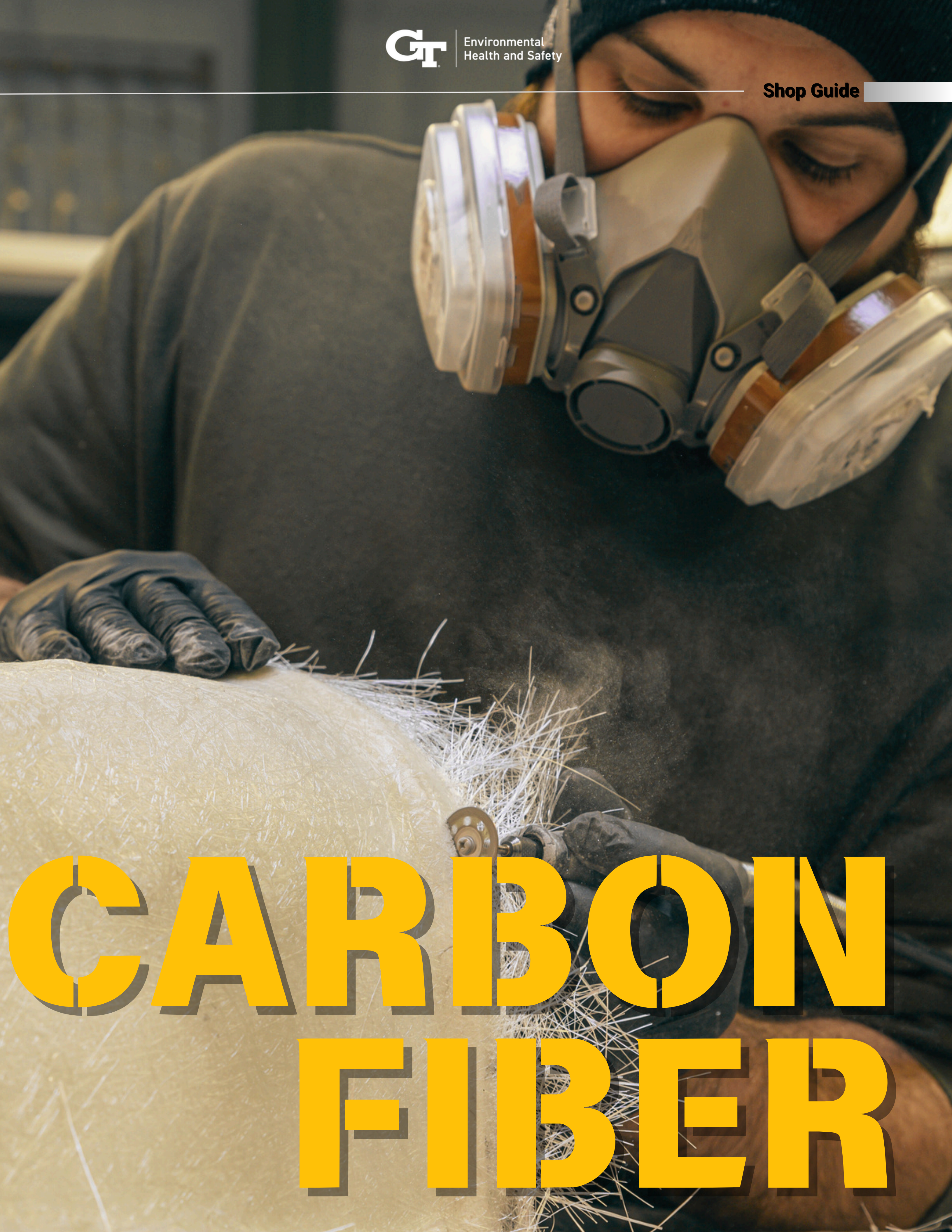
Additional Safety Tips

- Work in well-ventilated areas or under fume hoods.
- Allow resins to cure fully before sanding.
- Wear gloves and eye protection to avoid skin and eye exposure.

Environmental Health and Safety

Shop Guide

CARBON FIBER



Carbon Fiber and Fiberglass Work

Carbon fiber and fiberglass release fine fibers and particles that, if inhaled, can irritate the respiratory tract and potentially lead to long-term respiratory conditions. These fibers are thin and sharp, increasing the likelihood of respiratory irritation.

	CARBON FIBER AND FIBERGLASS
Hazards	Fine fibers released during cutting can irritate the respiratory system and lead to long-term lung issues if inhaled frequently.
Recommended Respiratory Protection	A half-mask respirator with P100 filters effectively captures fine airborne fibers 

Additional Safety Tips

- Keep cutting zones well-ventilated or use localized exhaust systems.
- Wear protective clothing to avoid skin contact with fibers.
- Use proper disposal methods for fiber waste.

Shop Guide

SPRAY PAINTING

Environmental
Health and Safety

Painting and Spray Painting

Painting and spray painting release airborne particles, fumes, and VOCs from solvents, which may cause respiratory irritation. Prolonged or high exposure can lead to more serious respiratory and systemic health effects.

	PAINT
Hazards	Paint particles and solvent vapors, such as VOCs (volatile organic compounds), can irritate the respiratory tract and cause central nervous system effects with prolonged exposure.
Recommended Respiratory Protection	Use a half-mask respirator with organic vapor cartridges and P100 filters to protect against paint particles and fumes. 

Additional Safety Tips

- Spray in controlled environments, such as paint booths.
- Use proper PPE, including goggles and gloves.
- Avoid eating or drinking in areas where paint particles are present.

SOLDERING + WELDING

Shop Guide

Environmental Health and Safety

Soldering and Welding

Soldering and welding generate metal fumes and flux vapors, and soldering may involve lead. These fumes are hazardous if inhaled over time, potentially causing metal fume fever or long-term lung damage.

	SOLDERING	WELDING
Hazards	Flux and metal fumes, including lead, can cause respiratory irritation.	Produces metal fumes containing zinc, iron, or other toxic metals.
Recommended Respiratory Protection	Use a P100 respirator or fume extraction system for prolonged tasks.   	Use a half-mask respirator with P100 filters to capture welding fumes effectively 

Additional Safety Tips

- Always work with adequate fume extraction or ventilation.
- Avoid prolonged exposure to welding fumes by taking breaks.
- Wear protective clothing and welding shields to prevent burns.

Environmental Health and Safety

Shop Guide

SPRAY CASTING

Spray Casting

Polyester and polyurethane chemicals release isocyanates, which are particularly harmful to the respiratory system and can cause severe respiratory reactions or sensitization.

	POLYESTER AND POLYURETHANE
Hazards	Releases isocyanates and other harmful chemicals, which can cause severe respiratory reactions or sensitization.
Recommended Respiratory Protection	A full-face respirator with organic vapor cartridges and P100 filters is required to protect against both respiratory and eye exposure. 

Additional Safety Tips

- Isolate spray casting activities in designated areas or use spray booths.
- Wear protective suits and gloves to avoid skin exposure.
- Minimize time spent in spray areas and take regular breaks in fresh air.

Environmental Health and Safety

RESPIRATOR USE, CARE AND MAINTENANCE

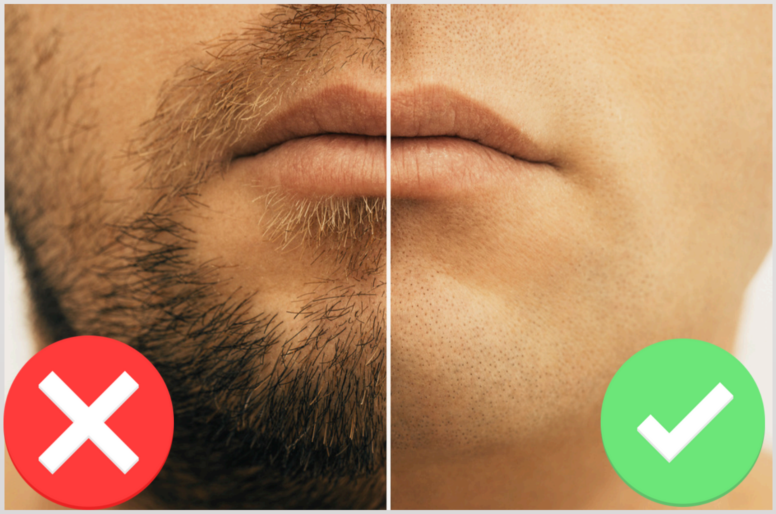
Fit Testing and Proper Fit

1. Fit Testing:

- ***Why:*** Determines if the respirator forms a proper seal against your face.
- ***When:*** Conduct fit testing annually or whenever changing the respirator type or size.

2. User Seal Check (Before Each Use):

- ***Positive Pressure Check:*** Cover the exhalation valve and exhale gently. The facepiece should puff slightly without leaking.
- ***Negative Pressure Check:*** Cover the filter inlets, inhale gently, and hold your breath for 10 seconds. The facepiece should collapse slightly without air leaks.



3. Facial Hair:

- Facial hair can prevent a proper seal. Ensure the area where the respirator seals to the face is clean-shaven.

Proper Use of Respirators

1. Donning the Respirator:

- Position the respirator over your nose and mouth.
- Adjust the straps to secure it snugly to your face.

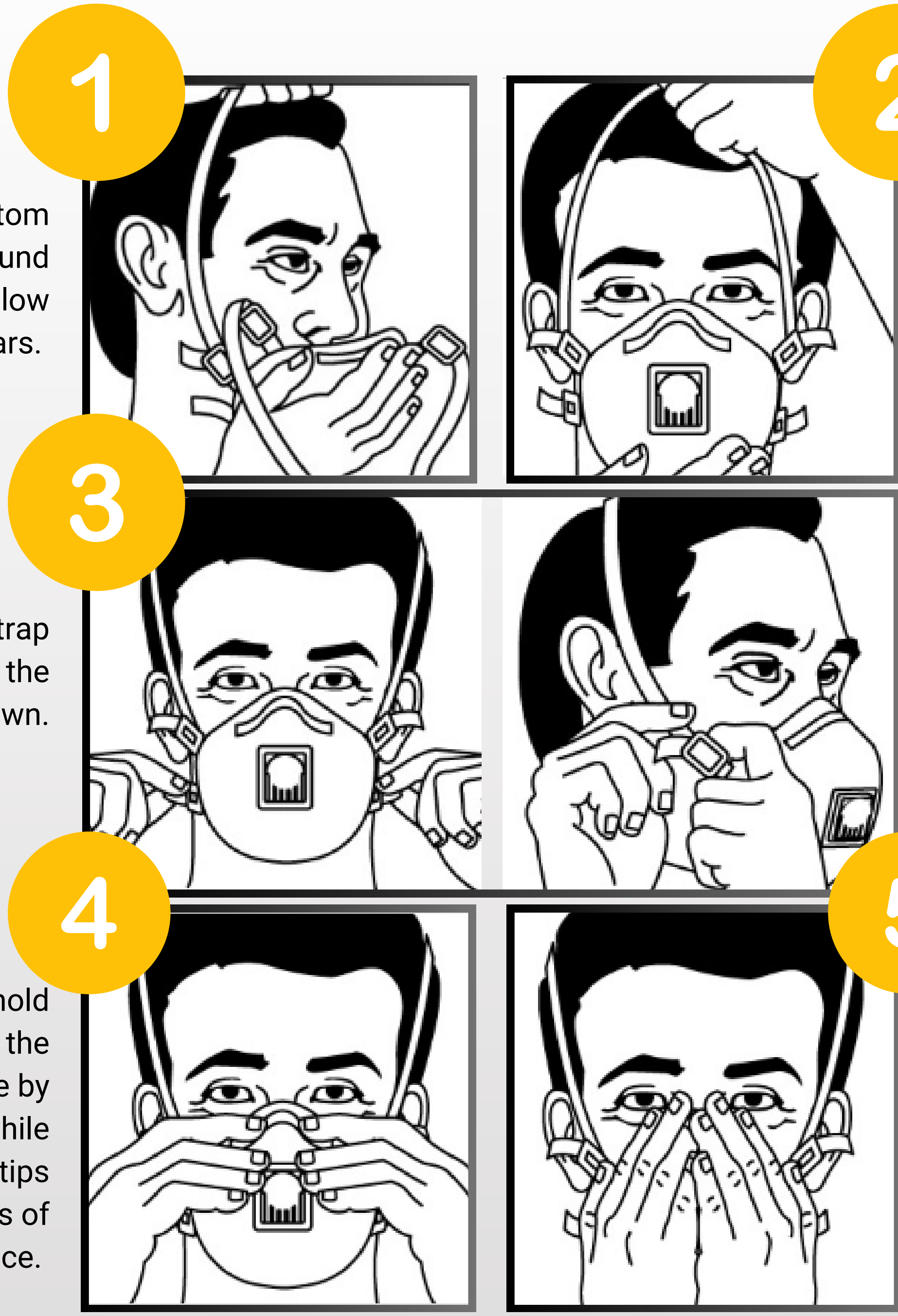
2. During Use:

- Avoid touching the facepiece while wearing the respirator.
- Replace filters or cartridges immediately if you notice increased breathing resistance, damage, or breakthrough of odors or irritants.

3. Doffing the Respirator:

- Remove the respirator without touching the facepiece to avoid contaminating yourself.
- Wash your hands after removing the respirator.

Donning Filtering Face Masks (N95/P100)



1. Place the bottom elastic strap around the head, just below the ears.

2. Pull the top strap over your head, resting it above the ears at the top back of your head.

3. Adjust the strap tension by pulling the straps as shown.

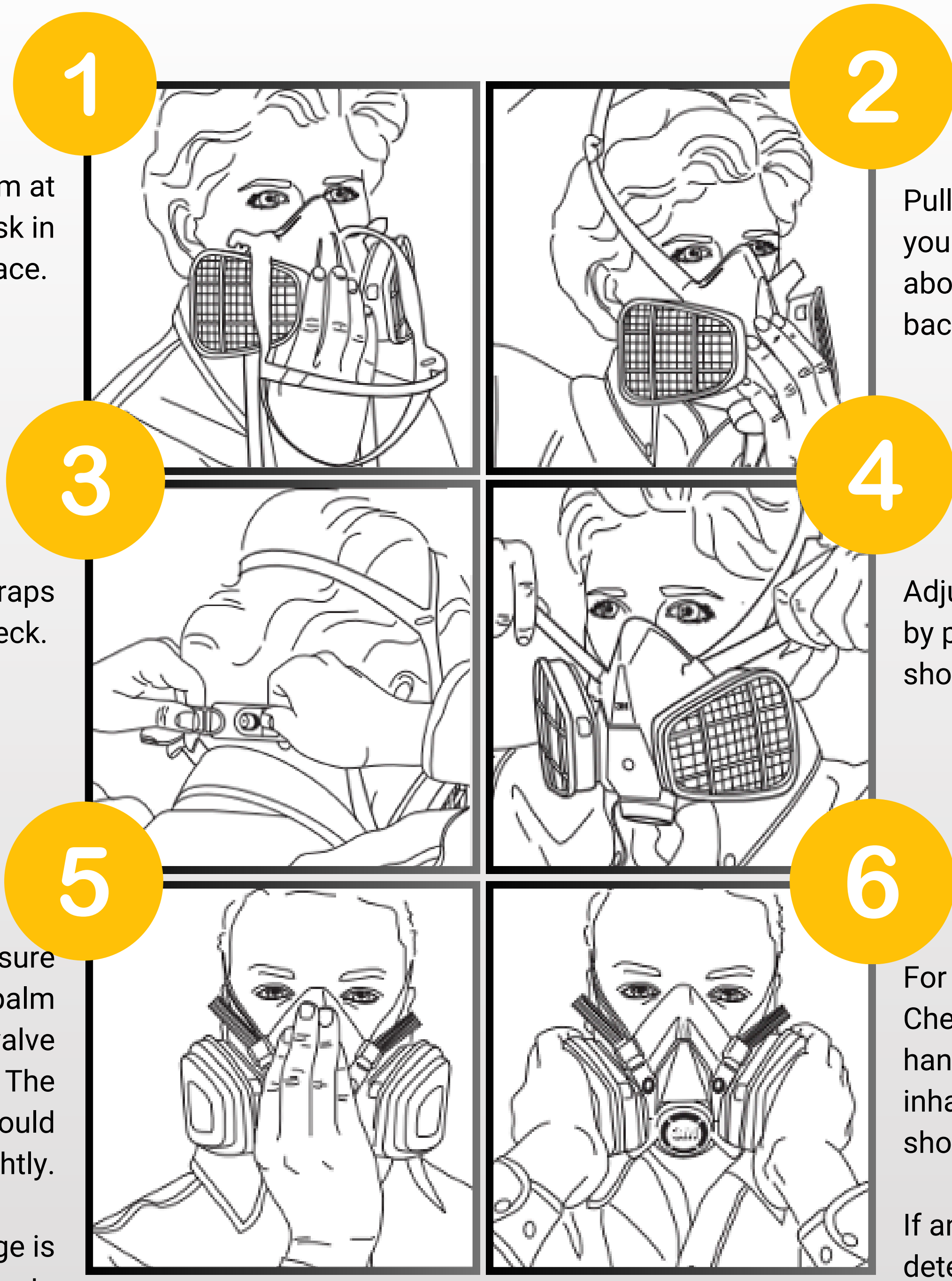
   Strap tension may be decreased without removing the respirator from the head by pushing out on the back of the buckle.

4. Using two hands, mold the nose area to the shape of your nose by pushing inward while moving your fingertips down both sides of the nosepiece.

5. Perform a Seal Check prior to each wear. Place both hands completely over the respirator and inhale sharply. The mask should collapse slightly.

   Be careful not to disturb the position of the respirator. If any leakage is detected, readjust.

Donning Half-Face Masks



Place the bottom at chin and hold mask in place.

Pull the top strap over your head, resting it above the ears at the top back of your head.

Fasten bottom straps behind neck.

Adjust the strap tension by pulling the straps as shown.

For Positive Pressure Check. Place palm over exhalation valve and exhale gently. The facepiece should bulge slightly.

If any leakage is detected, readjust.

For Negative Pressure Check. Place palms hand over cartridges and inhale gently. The mask should collapse slightly.

If any leakage is detected, readjust.

Donning Full-Face Masks

Place the bottom at chin and hold mask in place and pull straps over you head, resting on the crown of head with top straps above ears and bottom straps below.

Adjust the strap tension by pulling the straps as shown.

For Positive Pressure Check. Place palm over exhalation valve and exhale gently. The facepiece should bulge slightly.

If any leakage is detected, readjust.

For Negative Pressure Check. Place palms hand over cartridges and inhale gently. The mask should collapse slightly.

If any leakage is detected, readjust.

More Respirator Notes

Filter and Cartridge Replacement

To maintain effectiveness, replace filters and cartridges as follows:

- **Filters:** Replace when breathing becomes difficult or as recommended by the manufacturer.
- **Cartridges:** Replace when detecting odors, irritation, or at the end of the manufacturer's service life. Use color-coded cartridges to identify the appropriate protection.

Limitations of Respirators

Respirators are effective only when used properly, but they have limitations:

- They cannot provide oxygen in oxygen-deficient environments.
- They are not effective in environments with high concentrations of hazardous substances beyond their rating.
- Improper storage or maintenance can compromise their effectiveness.

Safety Tips for Respirator Use

- **Training:** Ensure you are trained in the proper use, care, and maintenance of your respirator.
- **Compatibility with Other PPE:** Make sure the respirator does not interfere with other protective equipment, such as goggles or helmets.
- **Inspect Before Use:** Check for damage, wear, or improper functioning before each use.

Importance of Proper Equipment Maintenance

Proper maintenance of respiratory protection equipment is crucial for ensuring its effectiveness against respiratory hazards. Regular upkeep extends the equipment's lifespan, prevents premature wear, and reduces the risk of malfunction during use. Below are key reasons for prioritizing maintenance and best practices to follow:

Ensuring Equipment Reliability

Regular maintenance ensures respiratory protection equipment stays effective by identifying and addressing defects or damage through routine inspections, reducing the risk of failure when needed most.

Preserving Performance

Respiratory protection equipment, like respirators and filters, depends on well-maintained components to provide effective protection. Regular cleaning, sanitizing, and part replacement ensure proper performance and compliance with safety standards.

Minimizing Contamination

Respiratory protection equipment can accumulate dust, particles, and biological agents during use. Regular cleaning removes these contaminants, reducing cross-contamination and preventing harmful buildup that could impact respiratory health.

Promoting Comfort and Compliance

Well-maintained equipment is more comfortable, promoting better compliance with respiratory protection protocols. Clean, properly fitting respirators reduce discomfort and irritation, encouraging consistent use and adherence to safety guidelines.

Best Practices for Equipment Maintenance

REGULAR INSPECTIONS

- Conduct a visual inspection before each use to check for damage, wear, or deterioration.
- Look for cracks, tears, or missing components that could compromise performance.
- Ensure all straps, valves, and seals are intact and functional.

CLEANING AND SANITIZING

- Clean equipment regularly using manufacturer-approved cleaning agents and disinfectants.
- Focus on areas that contact the face to remove dirt, oil, and debris that could affect the seal.
- Follow drying instructions to prevent moisture buildup, which can lead to mold or mildew.

STORAGE AND HANDLING

- Store equipment in a clean, dry location away from sunlight, extreme temperatures, and contaminants.
- Use protective cases or storage bags to prevent damage.
- Avoid placing heavy objects on respirators or exposing them to sharp edges that may cause punctures or tears.

REPLACEMENT OF COMPONENTS

- Replace worn or damaged parts, such as filters, cartridges, straps, and seals, as needed or per manufacturer recommendations.
- Check filters and cartridges for proper fit and function during replacements.
- Ensure all components are compatible with the equipment to maintain effectiveness.

Best Practices for Cleaning Equipment

1

Clean
Warm Water
(less than 120 degrees F)
Neutral Detergent
Soft Brush

2

Disinfect
Disinfectant Solution:
Quarternary Ammonia
OR
3 oz Household Bleach
and 2 gal Water

3

Rinse
Clean, fresh water

4

Air Dry
Non-contaminated
atmosphere

CLEANING IS RECOMMENDED AFTER EACH USE.

Respirator Cleaning Wipes may be used as an interim method in the cleaning schedule for individually assigned respirators, but this should not be the only method in place.

1. Remove cartridges and filters.

2. Clean facepiece (excluding filters) by immersing in warm cleaning solution, the water temperature should not exceed 49º C, and scrub with soft brush until clean. Add neutral detergent if necessary. Do not use cleaners containing lanolin or other oils.

3. Disinfect the facepiece by soaking in a solution of quaternary ammonia disinfectant or dilute sodium hypochlorite (30 mL household bleach in 7.5 L of water), or another suitable disinfectant.

4. Rinse in fresh, warm water and air dry in a clean non-contaminated area.

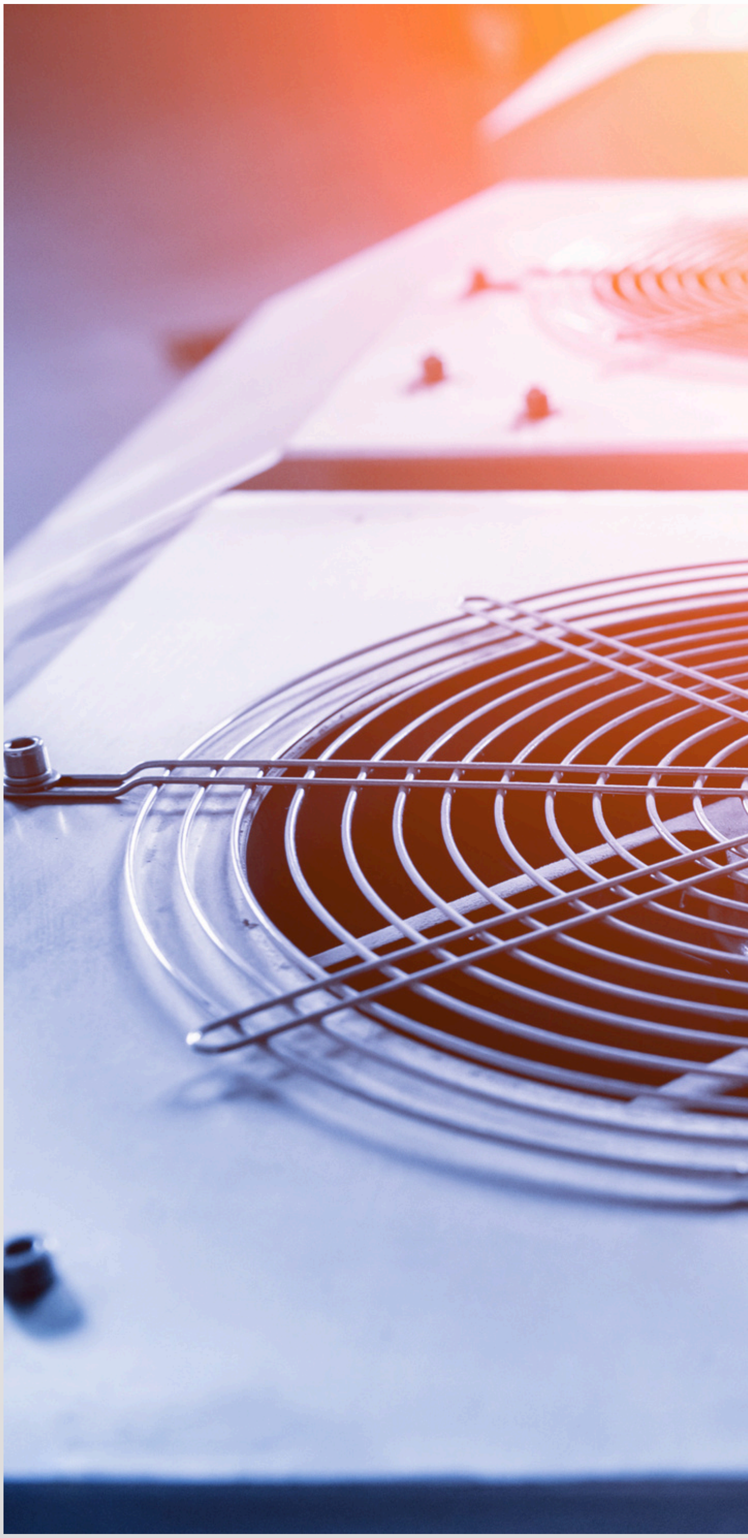
5. Inspect the respirator components prior to reassembly. A respirator with any damaged or deteriorated components must be repaired or discarded.

6. Store the clean respirator away from contaminated areas when not in use.

VENTILATION AND ENVIRONMENTAL CONTROLS

Ventilation and Environmental Controls

Effective ventilation and environmental controls are critical to maintaining air quality and reducing airborne hazards in makerspaces. While respiratory protection is essential, combining it with proper ventilation ensures a safer workspace by minimizing the concentration of dust, fumes, vapors, and other contaminants. This section explains the types of ventilation systems, their importance, and practical tips for improving environmental controls in your makerspace.



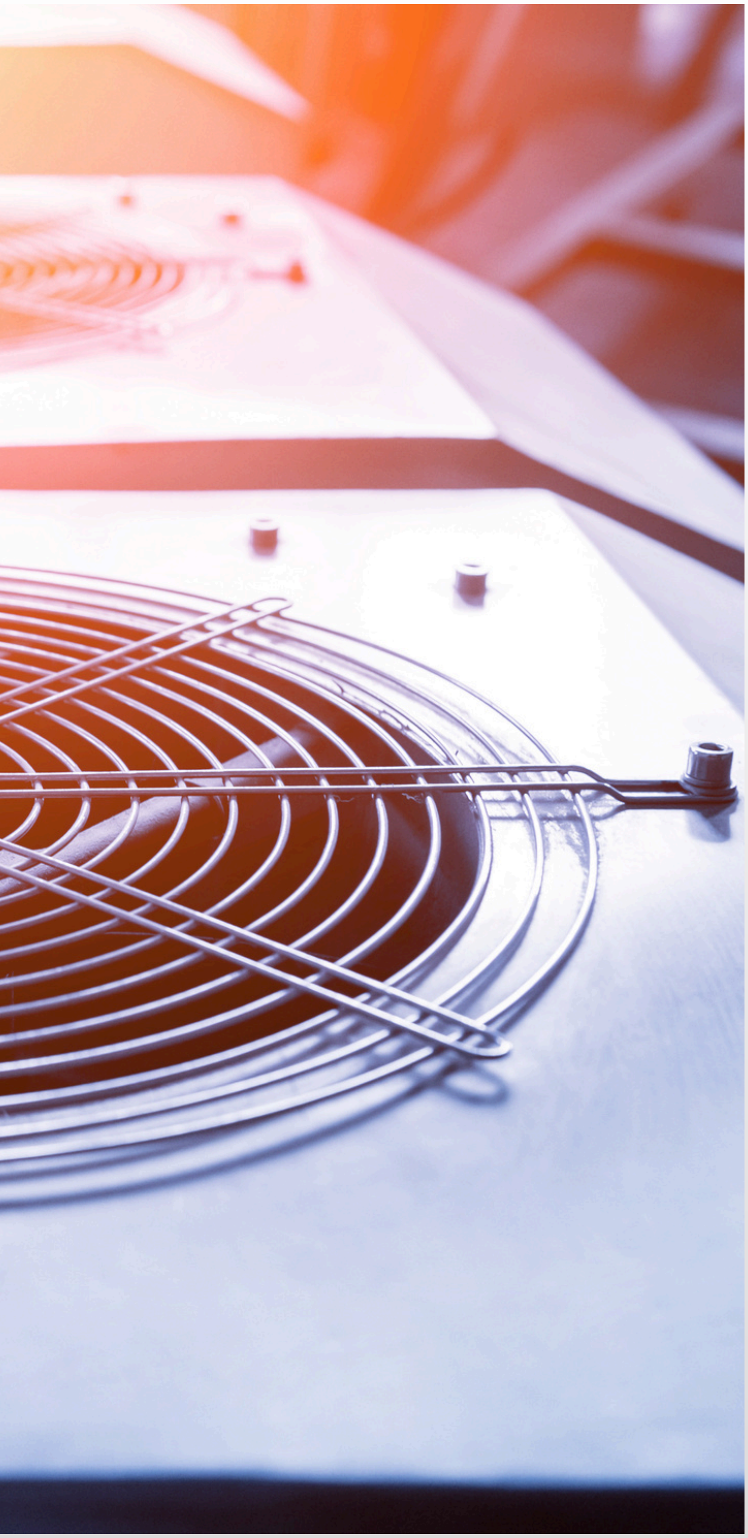
Importance of Ventilation in Makerspaces

Ventilation plays a key role in controlling airborne hazards by:

- **Diluting Contaminants:** Reducing the concentration of hazardous particles and vapors in the air.
- **Removing Pollutants:** Capturing and exhausting contaminants at the source to prevent exposure.
- **Improving Overall Air Quality:** Ensuring a cleaner, safer, and more comfortable work environment.

Without proper ventilation, even short-term exposure to airborne hazards can lead to respiratory irritation or more severe health risks over time.

Best Practices for Ventilation in Shops



Designate Work Zones

- Separate tasks with higher emission rates, such as spray painting or welding, into specific areas with dedicated ventilation systems.

Optimize Airflow

- Avoid obstructing vents or exhaust systems.
- Position workstations so that airflows move contaminants away from the breathing zone.

Inspect Ventilation Systems Regularly

- Check fume hoods, extractors, and filters for blockages or wear.
- Replace or clean filters as recommended by the manufacturer.

Supplement Ventilation with Respiratory Protection

- Always wear appropriate respirators for tasks involving high concentrations of dust, fumes, or vapors, even if ventilation is in place

Use Air Monitoring Tools

- Install air quality monitors to detect elevated levels of particulate matter, gases, or VOCs.
- Ensure compliance with OSHA or local air quality standards.

Types of Ventilation

Local Exhaust Ventilation (LEV):

- **Description**: A system designed to capture contaminants at their source and prevent them from spreading.
- **Examples**:
  - Fume extractors for welding and soldering.
  - Dust collection systems for sanding and cutting.
  - Spray booths for painting and chemical work.
- **Benefits**: Highly effective for controlling specific hazards directly at their origin.

General/Dilution Ventilation

- **Description**: A system that circulates air throughout the workspace to dilute airborne contaminants.
- **Examples**:
  - Ceiling fans or HVAC systems.
  - Open windows and doors for natural airflow.
- **Benefits**: Provides overall air circulation but is less effective than LEV for high-concentration hazards.

Natural Ventilation

- **Description**: Relies on natural airflows, such as open windows, doors, or outdoor workspaces.
- **Benefits**: Useful in small, low-risk environments but may not provide adequate protection for tasks involving high emissions

Dilution Ventilation		Local Exhaust Ventilation	
ADVANTAGES	DISADVANTAGES	ADVANTAGES	DISADVANTAGES
Usually lower equipment and installation costs.	Does not completely remove contaminants.	Captures contaminant at source and removes it from the workplace.	Higher cost for design, installation and equipment.
Requires less maintenance.	Cannot be used for highly toxic chemicals.	The only choice for highly toxic airborne chemicals.	Requires regular cleaning, inspection and maintenance.
Effective control for small amounts of low toxicity chemicals.	Ineffective for dusts or metal fumes or large amounts of gases or vapours.	Can handle many types of contaminants including dusts and metal fumes.	
Effective control for flammable or combustible gases or vapours.	Requires large amounts of heated or cooled makeup air.	Requires smaller amount of makeup air since smaller amounts of air are being exhausted.	
Best ventilation for mobile or dispersed contaminant sources.	Ineffective for handling surges of gases or vapours or irregular emissions.	Less energy costs since there is less makeup air to heat or cool.	

Courtesy of The Canadian Centre for Occupational Health and Safety (CCOHS)

Additional Environmental Controls

1. Housekeeping:

- Keep the workspace clean to reduce the accumulation of hazardous dust and debris.
- Use HEPA-filtered vacuums instead of sweeping to prevent resuspension of particles.

2. Task Scheduling:

- Schedule hazardous tasks during off-peak hours to minimize exposure to other makerspace users.
- Allow time for air to clear before resuming general workspace use.

3. Material Storage:

- Store chemicals, adhesives, and paints in designated areas with proper ventilation to reduce off-gassing into the workspace.
- Label storage areas clearly and follow safety data sheet (SDS) recommendations.

4. Noise Considerations:

- Combine noise control with ventilation by selecting quieter equipment, such as low-decibel fans or extractors, to maintain a comfortable workspace.

EMERGENCY PREPAREDNESS

Emergency Procedures

Even with proper safety measures in place, emergencies can happen in makerspaces. Being prepared for these situations is critical to protecting your health and ensuring a quick and effective response. This section outlines how to recognize respiratory exposure symptoms, respond to emergencies, and report incidents to maintain a safe and supportive environment.

Immediate Response Actions

Evacuation: Evacuate to a safe area and close doors as you exit the space. Follow the pre-determined evacuation routes posted in all campus buildings. Evacuation plans should be clearly displayed and regularly reviewed during training sessions.

Notification: Immediately report any respiratory emergency to Georgia Tech Police at **404-894-2500**, THEN GT EHS, through the designated emergency hotline at **404-216-5237**.

First Aid: Administer basic first aid as needed while awaiting the arrival of medical professionals. Specific training on how to handle respiratory distress should be part of the mandatory safety training for all staff.

Coodination with Emergency Services

Emergency Contact List: Maintain an up-to-date list of all key contacts, including local emergency services, hospital contact information, and specialized response teams.

Information Sharing: Provide emergency responders with information about the nature of the respiratory hazard as quickly as possible to facilitate an appropriate response.

Equipment and Supplies

Emergency Kits: Equip all relevant areas of the campus with emergency respiratory protection kits that include respirators, replacement filters, and other necessary safety equipment.

Maintenance Checks: Regularly check and maintain emergency equipment to ensure it is functional and accessible at all times.

Documentation and Reporting

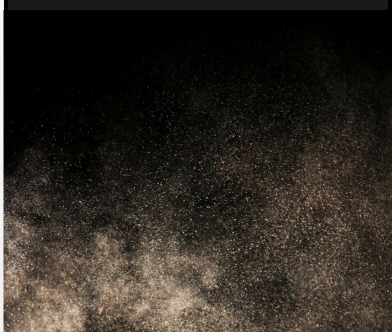
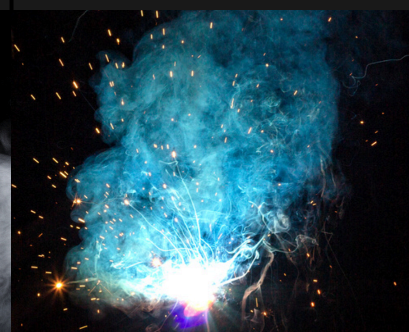
Incident Logs: Keep detailed logs of all emergency incidents and responses. These logs should include the date, time, details of the incident, actions taken, and outcomes.

Review and Update: Regularly review emergency procedures to reflect new risks, lessons learned from past incidents, and changes in regulatory requirements.

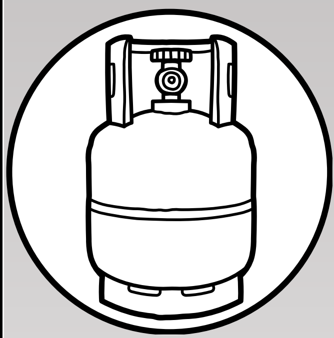
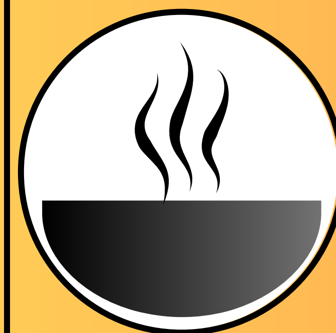
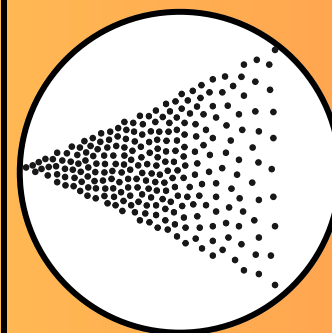
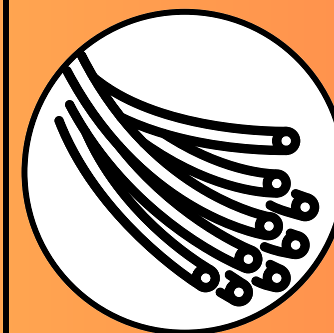
By establishing and maintaining robust emergency procedures, Georgia Tech ensures that its community is prepared to handle any respiratory hazard efficiently and effectively, minimizing risk and enhancing overall safety on campus.

Recognizing Symptoms of Overexposure

Respiratory exposure to hazardous contaminants may present immediate or delayed symptoms. Knowing these signs can help you identify and respond to overexposure quickly:

DUST AND PARTICULATES	VAPORS AND GASES	FUMES	ISOCYANATES OR FIBERS
			
Symptoms: Coughing, sneezing, shortness of breath, or throat irritation. **Long-term Risks:** Chronic respiratory conditions such as asthma or pneumoconiosis.	**Symptoms:** Dizziness, headaches, nausea, eye irritation, or a chemical odor. **Severe Exposure:** Confusion, loss of consciousness, or chemical burns.	**Symptoms:** Respiratory irritation, tightness in the chest, or metal fume fever (flu-like symptoms such as chills and fever).	**Symptoms:** Persistent coughing, wheezing, or allergic-like reactions such as skin irritation or eye redness.

Environmental Health and Safety

Gaseous		Particulate Matter			
GASES	**VAPORS**	**DUST**	**FUMES**	**MISTS**	**FIBERS**
					
Gases are invisible hazards that can come from chemical reactions, combustion, or specific materials used in makerspaces.	Vapors are airborne molecules released from liquids, such as solvents and adhesives, during use or drying.	Dust consists of fine solid particles generated by mechanical processes.	Fumes are tiny solid particles formed when materials are heated to a gaseous state and then cool and condense in the air.	Mists are liquid droplets suspended in the air, often formed during spray applications or machining.	Fibers are elongated particles that can become airborne during cutting or handling specific materials.
Examples: Carbon dioxide (CO_2), carbon monoxide (CO), chlorine, and hydrogen sulfide. Sources: Poorly ventilated areas, combustion engines, or chemical use.	Examples: Methylene chloride, toluene, and VOCs from paints and resins. Sources: Spray painting, solvent-based adhesives, cleaning agents, and resin application.	Examples: Wood dust, metal dust, silica, and composite dust. Sources: Sanding, cutting, grinding, and other fabrication activities.	Examples: Metal fumes from welding or soldering, including lead, zinc, and iron fumes. Sources: Welding, smelting, soldering, and high-temperature processes.	Examples: Paint mists, oil mists, and chemical sprays. Sources: Spray painting, cutting fluids, and other liquid-based operations.	Examples: Fiberglass and carbon fibers. Sources: Cutting or sanding composite materials and fiberglass insulation.

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Breathing safely is not just a necessity; it's a right. Our commitment to respiratory protection ensures that every breath taken on campus is a step towards a healthier future.

Written Program

General. The Occupational Safety and Health Administration (OSHA) General Industry standard for respiratory protection 29 CFR 1910.134 requires that an employer establish a written respiratory protection program. The following procedures are based on the requirements established by OSHA.

Policy. Georgia Tech's policy is to provide its students, faculty, and staff with a safe and healthful work environment. The guidelines in this program are designed to help reduce community exposure to occupational air contaminants and oxygen deficiency.

Responsibilities

According to OSHA, every year, more than 5,000 workers are killed on the job (a rate of 14 per day), and more than 3.6 million suffer a serious job-related injury or illness

The primary objective is to prevent excessive exposure to these contaminants. This is accomplished as far as feasible by accepted engineering and work practice control measures. When effective engineering controls are not feasible, or while they are being implemented or evaluated, respiratory protection may be required to achieve this goal. In these situations, respiratory protection is provided at no cost to students, faculty, or staff.

Management. It is the Environmental Health and Safety Department at Georgia Tech's Laboratory and Chemical Safety Team's responsibility to determine what specific applications require respiratory protective equipment. EHS must also provide proper respiratory protective equipment to meet the needs of each specific application. Enrollees must be provided with adequate training and instructions on all equipment

Supervisory. Supervisors of each area are responsible for ensuring that all personnel under their control know the respiratory protection requirements for their work areas. They are also responsible for ensuring that their subordinates comply with all facets of this respiratory protection program, including respirator inspection and maintenance. They are responsible for implementing disciplinary procedures for Georgia Tech's Respiratory Protection Program enrollees who do not comply with respiratory program requirements.

Enrollees. The enrollee of Georgia Tech's Respiratory Protection Program is responsible for being aware of the respiratory protection requirements for their work areas (as explained by EHS). Enrollees of Georgia Tech's Respiratory Protection Program are also responsible for wearing the appropriate respiratory protective equipment according to proper instructions and for maintaining the equipment in a clean and operable condition.

Program Admin

The following individual has total and complete responsibility for the administration of the respiratory protection program:

Elizabeth Henry

Elizabeth Marie Henry, MS, ASP
Laboratory & Chemical Safety Specialist
Environmental Health & Safety

This individual has the authority to act on any and all matters relating to the operation and administration of the respiratory protection program. All employees, operating departments, and service departments will fully cooperate. This person is referred to as the Respiratory Protection Program Administrator in this program. This individual is responsible for monitoring or conducting an exposure assessment of the respiratory hazard, developing worksite-specific procedures for this program, maintaining records, and conducting program evaluations.

Program Evaluation. The Program Administrator will also review and evaluate the entire program at least every 12 months.

Program Requirements

Medical Evaluation. Every enrollee who is being considered for inclusion in the Respiratory Protection Program must participate in a medical evaluation. The enrollee's ability to wear a respirator while working is initially determined before fit testing. Additional evaluations are made when there is a change in workplace conditions or information indicating a need for re-evaluation.

The program administrator will obtain from the Physician or other licensed healthcare professional or PLHCP a written medical determination regarding the employee's ability to use the respirator. If the PLHCP deems it necessary, the employee will receive a follow-up examination. This examination is provided at no cost to the enrollee. The medical evaluation aims to ensure that the enrollee is physically and psychologically able to perform the assigned work while wearing respiratory protective equipment.

If the PLHCP denies approval, the enrollee cannot participate in the Respiratory Protection Program. A medical evaluation must be completed before respirator training, fit testing of tight-fitting respirators, and use.

Copies of the medical evaluation and questionnaire will be kept as a medical record in accordance with 29 CFR 1910.1020. A copy of the written medical determination will be kept in the enrollee's file.

Risk Assessment. Exposure assessment will be done to ensure proper respirator selection. To determine the exposure level, air samples of the workplace representative of the work period, exposure assessment based on analogous processes, or professional judgment will be used. Personal sampling equipment may be used in accordance with accepted industrial hygiene standards to sample each work area. The results of these samples will pinpoint areas where respiratory protection is required.

The exposure assessment will be performed prior to the task requiring respiratory protection. Periodically thereafter, as required by OSHA substance specific standards or at least every 12 months, a review of the exposure assessment will be made to determine if respiratory protection is still required.

Program Requirements continued...

Respirator selections will be reviewed to ensure their continued suitability if respiratory protection is still necessary.

Note: The program administrator can establish more frequent evaluations/ assessments.

Respirator Selection. Respirators are selected and approved for use by management. The selection is based on the physical and chemical properties of the air contaminants and the concentration level likely to be encountered by the employee.

The Respiratory Protection Program Administrator will make a respirator available immediately to each employee who is assigned to a job that requires respiratory protection.

Replacement respirators/cartridges and filters will be made available as required. When chemical cartridge respirators are used, the program administrator will establish a cartridge change schedule based on objective information or data.

Use of Respirators. All tight-fitting respirators (both negative and positive pressure) shall not be used with beards or other facial hair or any other condition
that prevents direct contact between the face and the edge of the respirator or interferes with valve function.

Fit testing ensures the expected level of protection is provided by minimizing the total amount of contaminant leakage into the respirator.

Enrollees will be required to leave the contaminated area:

- Upon malfunction of the respirator.
- Upon detection of leakage of contaminant into the respirator.
- If increased breathing resistance of the respirator is noted.
- If severe discomfort in wearing the respirator is detected.
- Upon illness of the respirator wearer, the sensation of dizziness, nausea, weakness, breathing difficulty, coughing, sneezing, vomiting, fever, and chills.
- To wash face to prevent skin irritation.
- To change filter/cartridge elements or replace respirators whenever they detect the warning properties of the contaminant or increased breathing resistance or in accordance with the cartridge change schedule.

Training + Fit Testing

Training. Enrollees assigned to jobs and endeavors requiring respirators will be instructed by their supervisor relative to their responsibilities in the respiratory protection program. They will also be instructed in the need, use, limitations, and care of their respirator. Retraining is given at least every 12 months after initial training.

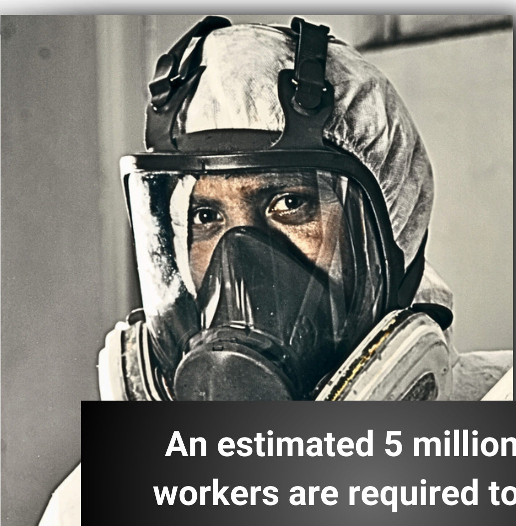
Fit Testing. Enrollees will be properly fitted and tested for a face seal before using the respirator in a contaminated area. Quantitative fit testing will be the method of fit testing.

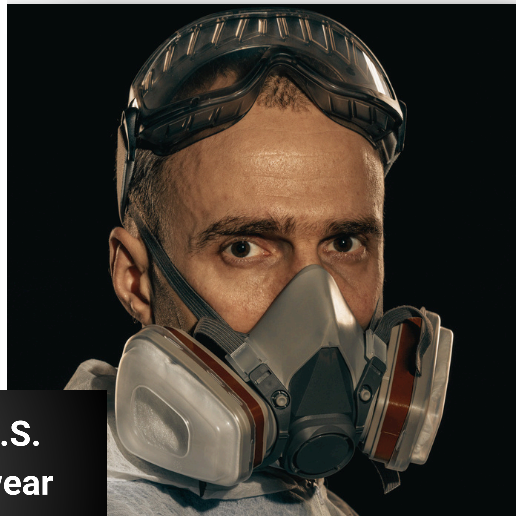
Fit testing will be done initially upon the enrollee's assignment to an area where tight-fitting respirators are required. Fit testing will be repeated at least every 12 months thereafter. All tight-fitting respirators (negative and positive pressure) will be fit tested. Positive pressure tight-fitting respirators will be fit-tested in the negative pressure mode.

Fit testing will not be done on enrollees with facial hair that passes between the respirator seal and the face or interferes with valve function. Such facial hair includes stubble, beards, and long sideburns.

During fit testing, enrollees will be shown the proper maintenance and care specific to their type of respirator.

Note: If it is determined that an individual cannot obtain an adequate fit with any tight-fitting respirator, a loose-fitting powered air purifying or supplied air respirator may be required instead.





An estimated 5 million U.S. workers are required to wear respirators for their job.

Care + Maintenance

Respirators must be properly maintained to retain their original effectiveness. The maintenance program will consist of periodic inspection, repair, cleaning, and proper storage.

Inspection. The wearer of a respirator will inspect it daily whenever it is in use. The program administrator or members of EHS will periodically spot-check respirators for fit, usage, and condition. The use of defective respirators is not permitted. If a defective respirator is found during inspection, it must be returned to the program administrator.

Repair. During cleaning and maintenance, respirators that do not pass inspection will be removed from service and will be discarded or repaired. Repair of the respirator must be done with parts designed for the respirator in accordance with the manufacturer's instructions before reuse. No attempt will be made to replace components or make
adjustments, modifications, or repairs beyond the manufacturer's recommendations.

Cleaning. Respirators not discarded after one shift use, except filtering facepiece type, will be cleaned on a daily basis (or after each use if not used daily), according to the manufacturer's instructions, by the assigned employee or other person designated by the Respiratory Protection Program Administrator.

Storage. Respirators not discarded after one shift use will be stored in a location where they are protected from sunlight, dust, heat, cold, moisture, and damaging chemicals. They shall be stored in a manner to prevent deformation of the facepiece and exhalation valve.

Whenever feasible, respirators not discarded after one shift use will be marked and stored in such a manner to assure that they will be worn only by the
assigned employee. If use by more than one employee is required, the respirator will be cleaned between uses.

Environmental Health and Safety

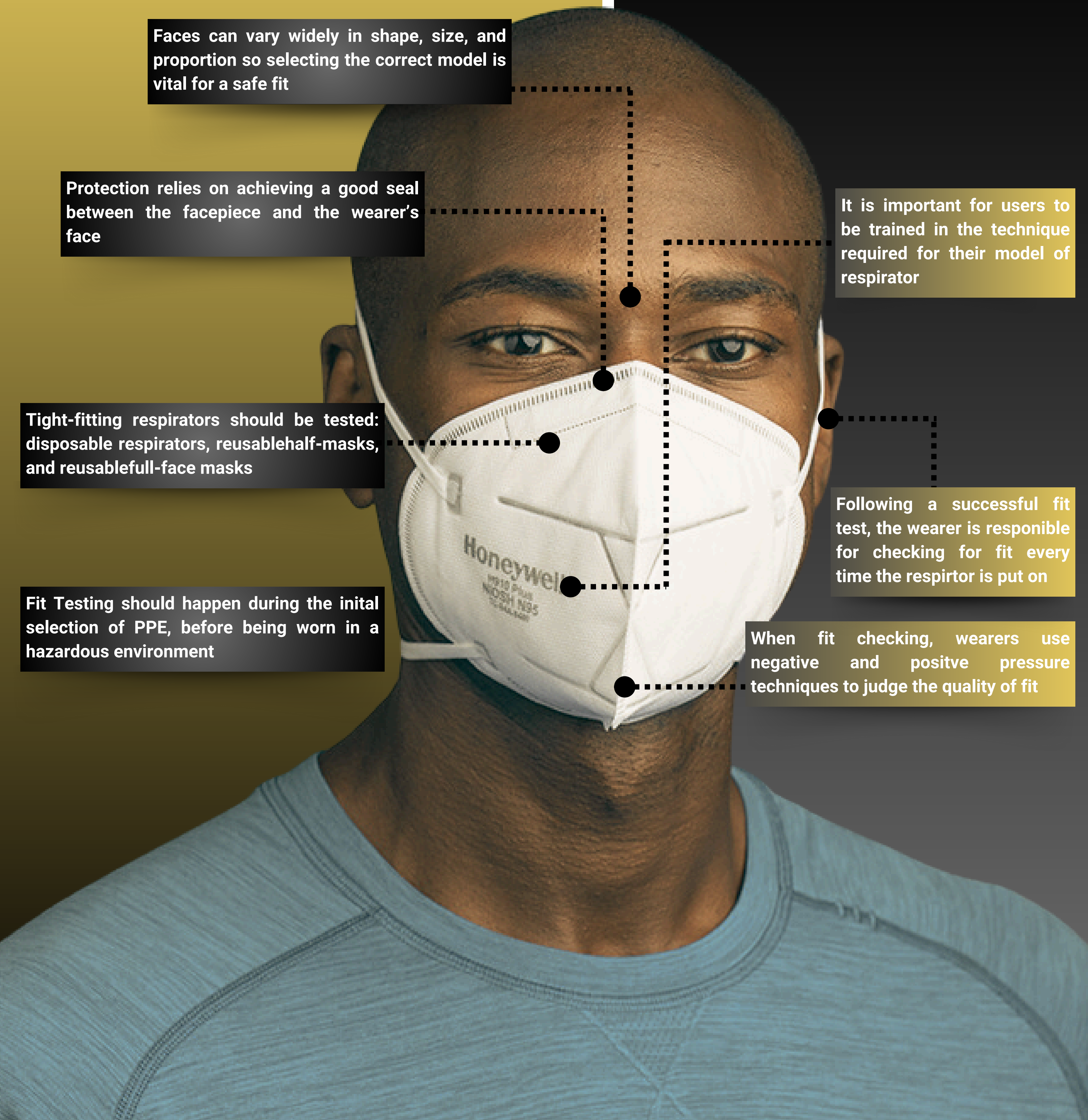
Shop Guide

Fit Test

the responsibility of the GT EHS

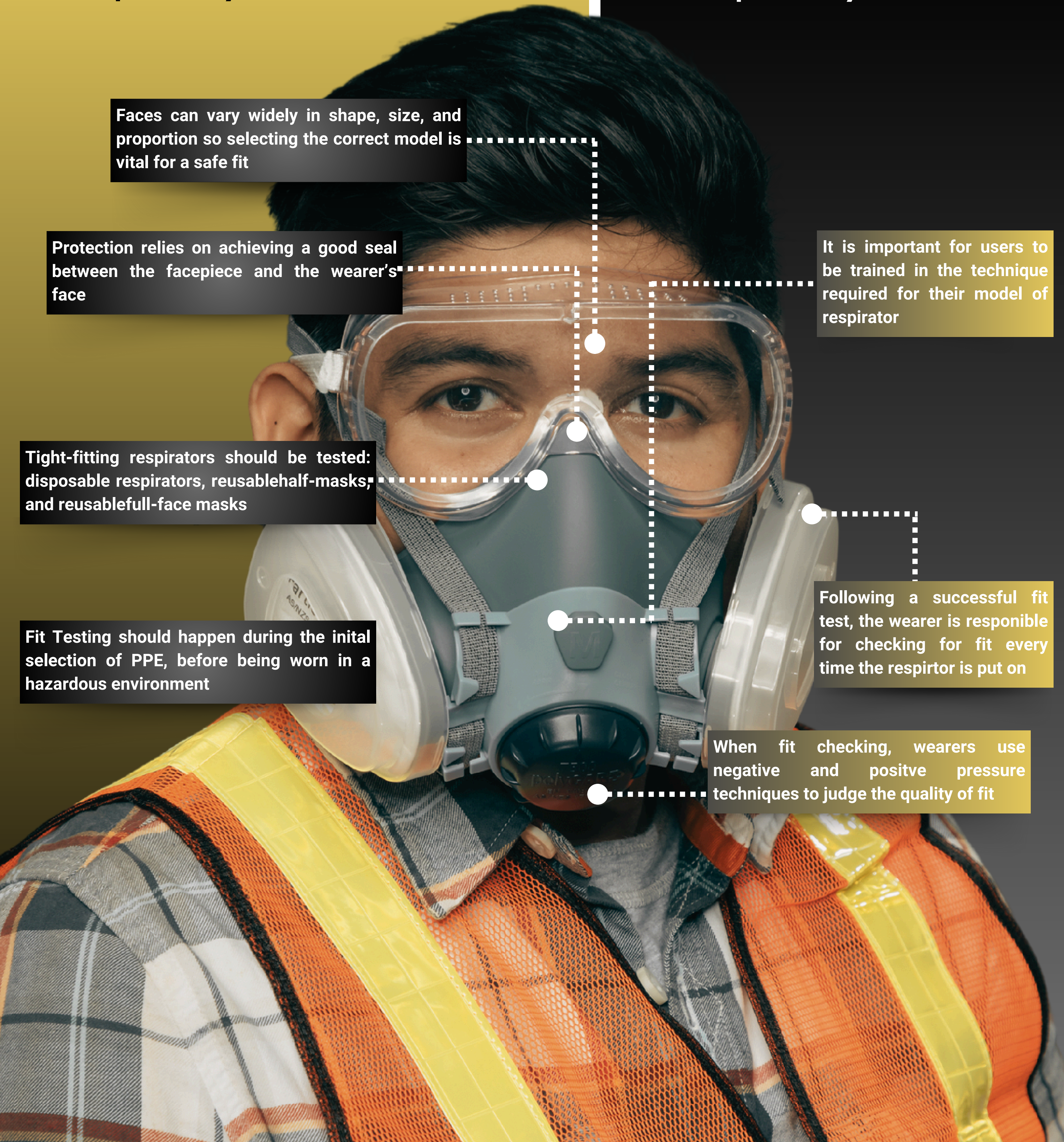
Fit Check

the responsibility of the wearer



Fit Test
the responsibility of the GT EHS

Fit Check
the responsibility of the wearer



Fit Test
the responsibility of the GT EHS

Fit Check
the responsibility of the wearer