AgSafe ALBERTA

RESPIRATORY PROTECTIVE EQUIPMENT (RPE)

AWARENESS MANUAL

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MANUAL VERSION 1.0

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Table of Contents

KEY POINT TO REMEMBER

There is a Glossary at the end of this manual to support your understanding of the terms used.

The following abbreviations have been used to make this manual easier to read:

- Occupational Health and Safety will be written as **OHS**.
- Occupational Health and Safety Act will be written as **OHS Act**.
- Occupational Health and Safety Code will be written as **OHS Code**.
- Canadian Standards Association or CSA Group will be written as **CSA**.

Foreword & Introduction

In this part of the manual, readers will:

1. Be introduced to AgSafe Alberta **& how occupational health and safety legislation applies to farms and ranches.**
2. Learn about the Canadian Standards Association (CSA), or CSA Group, and how their **standards can apply to occupational health and safety legislation.**
3. Gain an understanding of what a **Respiratory Protective Equipment** Code of Practice and Respiratory **Protection Program are.**
4. Be introduced to the roles and **responsibilities that relate to a Respiratory Protection Program,** such as the Program Administrator.

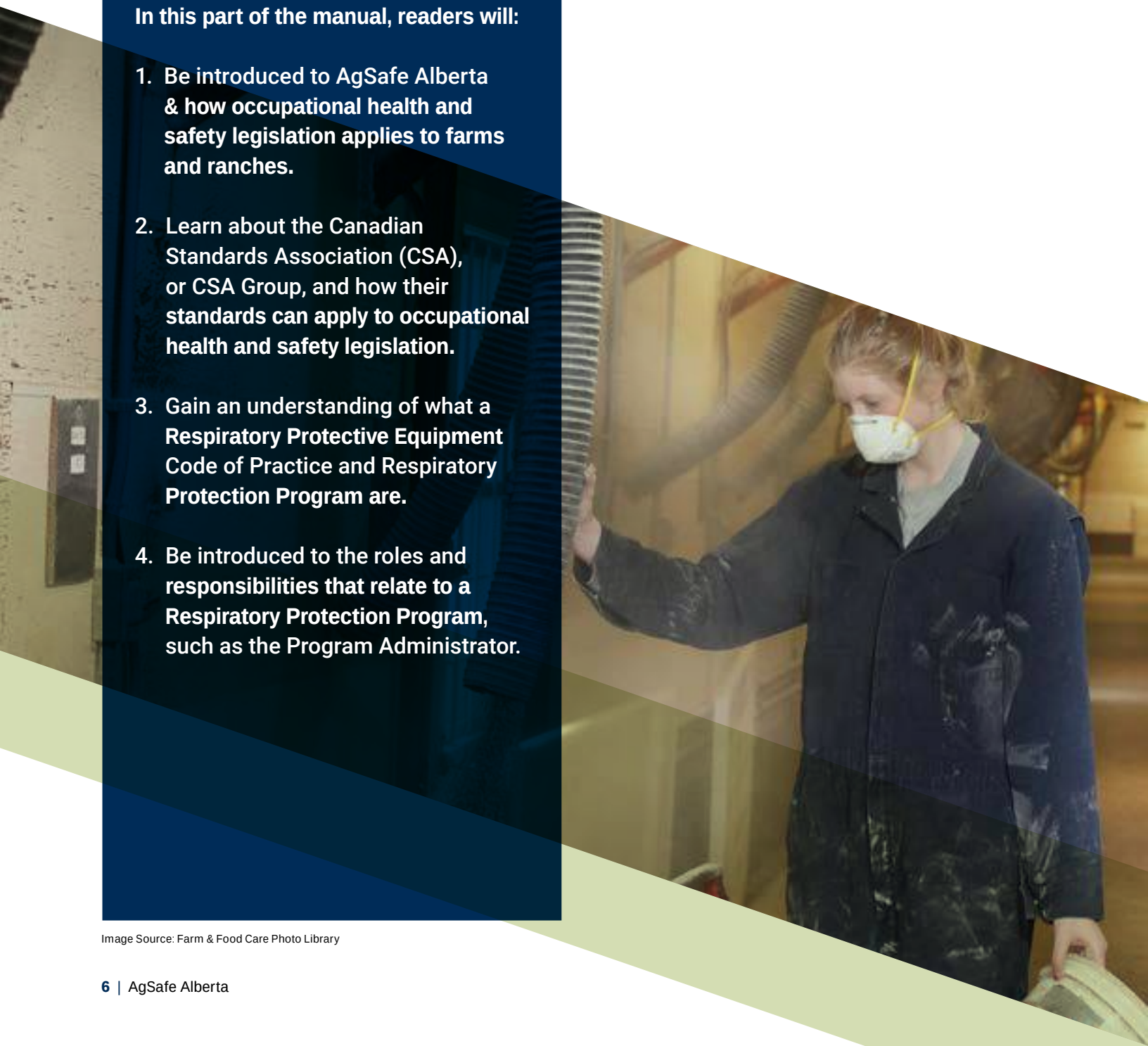


Image Source: Farm & Food Care Photo Library

Foreword

Welcome to the AgSafe Alberta Respiratory Protective Equipment Awareness Manual, a resource designed specifically to help you recognize and protect your farm team from respiratory and atmospheric hazards.

AgSafe Alberta is the health and safety association for agricultural producers in our province. It is a non-profit organization that works with and supports farms and ranches of all types and sizes in becoming safer. The AgSafe Alberta Board of Directors is made up of producers who represent various commodity groups and producer organizations, this helps ensure that the work being done is truly ***producer driven safety*.**

Background

In 2011, the Minister's Farm Safety Advisory Council recommended increased education, training and certification opportunities for Alberta farms. As a result, Alberta Agriculture and Forestry worked with the Canadian Agricultural Safety Association and Alberta's Partnerships in Injury Reduction (PIR) to develop the original Alberta FarmSafe Plan, a tool to help farms and ranches develop a health and safety program.

In 2019, AgSafe Alberta licensed the Alberta FarmSafe Plan from the Government of Alberta. The manual and workbook are updated regularly to stay current, and a certification program has been developed to help farms and ranches show their ongoing commitment to health and safety on their operation.

A Brief Timeline of Occupational Health and Safety (OHS) Legislation in Alberta

January 1, 2016: Bill 6 Enhanced Protection for Farm and Ranch Workers Act

- Made Alberta farms and ranches subject to occupational health and safety legislation.

January 31, 2020: Bill 26 Farm Freedom and Safety Act

- The entire OHS Act remained applicable to farming operations, but the OHS Code was no longer being directly applied. With these changes the "technical rules" that had been added to the OHS Code to address some aspects of safety on farming and ranching operations were lost.
- Some producers mistakenly thought their operations were exempt from all OHS legislation or that they were only responsible for "basic safety," when in reality they remained responsible for doing everything reasonable to protect the health and safety of workers.

December 1, 2021: AR 27/95 Farming and Ranching Exemption Repeal Regulation

- When the Farming and Ranching Exemption Repeal Regulation came into effect, it made part of the Alberta Occupational Health and Safety Code applicable to farming and ranching operations.
- At the time of publication, farming and ranching operations are exempt from most of the OHS Code, however the expectation for a farm owner, employer, or manager to take every practicable measure to protect the health and safety of the people working on the farm is the same as in any other industry.

The OHS Code is reviewed every few years. It is reasonable to expect additional changes that will affect farming and ranching operations to occur with each of these reviews. You will want to make efforts to stay informed of these changes and updates.

RESOURCE

- To gain a better understanding of how OHS legislation applies to your particular operation, refer to the Alberta FarmSafe Plan Manual and the free, self-paced online AgSafe Alberta FarmSafe Plan Learning Program found at **agsafeab.ca**.
- Visit **agsafeab.ca** to subscribe to the free AgSafe Alberta monthly newsletter that focuses on farm safety affairs and highlights legislative health and safety matters that affect agricultural operations.
- Follow AgSafe Alberta on Instagram, X, and Facebook to help you stay current on farm safety matters.

The OHS Act, Code and Your Farm

The OHS Act and Code set minimum standards for health, safety and wellness in Alberta's workplaces. It is intended to keep workplaces healthy and safe in addition to protecting the people working at a worksite, such as a farm, and those who may be impacted by the work being done.

OHS Act	OHS Code
Applies directly to farms & ranches.	Most of the OHS Code does not directly apply to farms & ranches.
Assigns obligations, responsibilities and duties to individuals and organizations.	The Alberta OHS Code provides minimum technical requirements for health and safety in Alberta's workplaces (Government of Alberta, n.d.).
Assigns the obligation to take every reasonably practicable measure to protect the health and safety of: • Workers and volunteers. • Contractors (e.g., custom harvest crews or veterinarians). • Service providers (e.g., tire repair service). • Visitors (e.g., tours during Alberta Open Farm Days). • Others who may be affected by hazards originating from the worksite.	Following the OHS Code may not be enough to protect an employer from charges should an incident occur; the minimum requirements outlined in the OHS Code may not be enough to control the particular hazards of a situation or set of work conditions.

KEY POINTS TO REMEMBER

Volunteers are people who perform or provide services without being paid, however, they are still considered to be workers (but not regularly employed workers) and have the same health and safety rights and responsibilities as any other workers under Alberta OHS legislation (Government of Alberta, 2022, p.1).

Act: A form of law that allows a government to regulate an area, such as Occupational Health and Safety (Government of Canada, 2011).

Codes: Codes are pieces of legislation that can be enforced.

Reasonably practicable: 1. Meeting a legislated occupational health and safety obligation in a way that is sensible, realistic and would be thought of as making sense for the facts and conditions by a reasonable person. 2. A recognized term that is based on the reasonable person test, which asks, what would a dozen of your peers consider reasonable in similar circumstances (Government of Alberta, 2017, p.1)?

Regulations: Regulations commonly list the requirements for specific workplace conditions and work practices in more detail than an Act. Regulations can be sector specific (as we have seen with farming and ranching) or hazard specific.

Volunteer: Someone who performs or provide services without being paid and have the same health and safety rights and responsibilities as any other workers under Alberta OHS legislation; a volunteer is still a worker, but they are not considered to be a regularly employed worker (Government of Alberta, 2022, p.1).

Introduction

This manual and the accompanying course are designed to help farmers & ranchers, their family members, supervisors, and workers to better:

- Better understand some different types of respiratory protective equipment, their uses & their limitations.
- Care for and maintain respiratory protective equipment.
- Understand what a respiratory protection program looks like and provide guidance on how to create one that meets the needs of your operation.

The information in this manual does not replace what is in Alberta Occupational Health and Safety (OHS) Legislation, but it will support you meeting your obligations and most importantly, it will help you better protect the people on your farm or ranch from respiratory and atmospheric hazards.

KEY POINTS TO REMEMBER

- Should you have any questions relating to agricultural health and safety, please email AgSafe Alberta at **info@agsafeab.ca**.
- To keep this manual as applicable to agricultural awareness applications as possible, the information contained within is not inclusive of all types of respiratory protective equipment or uses.

CSA Standards

The Canadian Standards Association (CSA), or CSA Group, is made up of industry, government, and consumer group representatives who develop standards for various industries. The standards that the CSA Group develops are sometimes used in occupational health and safety legislation and can be thought of as best practices on the subject addressed in the standard.

An example of this is found in the Alberta Occupational Health and Safety Code, which states "An employer must ensure that respiratory protective equipment used at a worksite is selected in accordance with CSA Standard Z94.4-02 *Selection, use and care of respirators*" (Alberta Occupational Health and Safety Code, 2023, s.247).

RESOURCE

You can access and view many CSA Standards at no cost by visiting **community.csagroup.org** and creating an account.

KEY POINT TO REMEMBER

At the time of publication, the Alberta Occupational Health and Safety Code references CSA Standard Z94.4-02 *Selection, use and care of respirators*, however, this standard has since been updated. The current version of this standard is the CSA Standard Z94.4-18 *Selection, use and care of respirators* and is the version referenced in this manual.

Respiratory Protective Equipment Code of Practice Versus Respiratory Protection Program

A Respiratory Protective Equipment Code of Practice (which is referenced in the Alberta Occupational Health and Safety Code) and a Respiratory Protection Program (which is referenced in CAN/CSA Standard Z94.4-18 *Selection, use and care of respirators*) are both written guidelines containing similar information that have been set out by the Alberta Government and the CSA Group respectively for the purpose of helping employers become compliant with various standards and legislation, and ultimately help employers protect the health and safety of their workers.

Having a written guideline, regardless of whether you call it a program or a code of practice, is a highly recommended best practice for farms and ranches. Involving the people on your farm in the development of your respiratory protection program will help ensure that it makes sense for your particular operation and the work being performed on it. This approach will also make it more likely to be followed by everyone on your farm; you can read more on this in Module 5: Respirator Selection.

Roles and Responsibilities

If your farm uses respiratory protective equipment, the roles and responsibilities relating to the respiratory protection program should be assigned and detailed in writing. The roles identified may include the farm owner, the program administrator, the fit tester, supervisors, employees, contracting employers, health care providers, etc.

You will notice the term **program administrator** being used periodically in this manual. This term refers to the person designated by the farm to be responsible for the administration of, and other duties relating to, the use of respirators. It is essential that this role and the assigned duties be performed by a competent person.

A respiratory protection program can have a lot of parts, so some of the duties related to administering a program may be assigned more than one person so long as each person has enough time in their day to do it, access to the necessary resources, and is competent to perform their duties to an acceptable level.

NOTE

Details relating to each of these roles and their associated responsibilities can be found in Clause 5 of CAN/CSA Standard Z94.4-18 *Selection, use and care of respirators.*

IMPORTANT

- To make the information presented in this manual easier to read and to align it with CAN/CSA Standard Z94.4, the term **Respiratory Protection Program** will be used rather than Respiratory Protective Equipment Code of Practice.
- Some of the duties related to administering a program may be assigned to more than one person so long as each person has the time, resources, and is competent to perform their duties to an acceptable level.

Code of practice: A written guideline that provides detailed information on a subject and is used to help ensure that legislative, ethical and health standards are met.

Competent person: A person who is adequately qualified, suitably trained, has the necessary attitude, and has enough experience to safely perform work without or with only a minimal degree of supervision (Occupational Health and Safety Act, 2023, s.1(d)).

Program administrator: The person designated by the farm to manage and direct the respiratory protection program.

Respiratory protection program: Farm specific written procedures and policies that together enhance employee health, promote the effective use of respiratory protective equipment, and make it easier to meet legislative, ethical and health standards.

Responsibilities: The tasks or duties that people in various positions are expected to complete as a function or part of their job.

Role: The position or purposes that someone has in a situation or organization; the position held by someone on the farm.

Standard: A voluntary way of doing something that has been agreed upon by a company itself, by an industry, or by a recognized organization such as the CSA Group.

MODULE

1

Why Farmers Need Respiratory Protection

In this module, readers will:

1. Become familiar with respiratory diseases and illnesses associated with agricultural work.

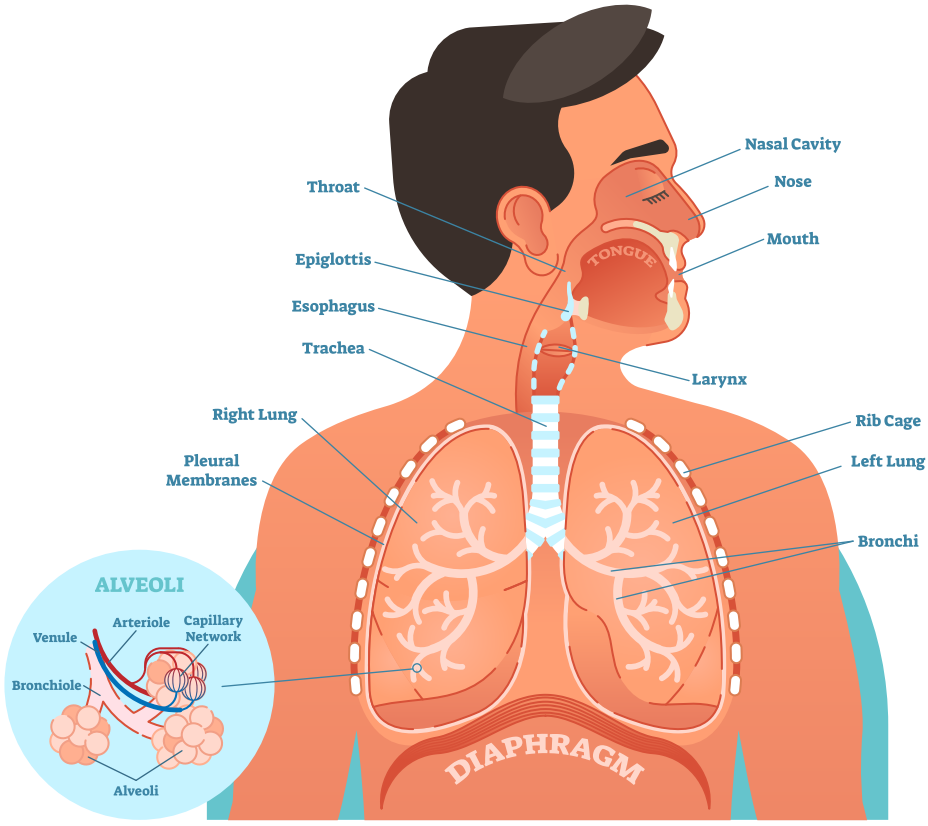
2. Learn to identify respiratory & atmospheric hazards commonly found on farms and ranches.

INTRODUCTION

Farming is filled with respiratory and atmospheric hazards, such as pesticide vapours and mists, crop and feed dusts, mould spores, and even toxic gases like hydrogen sulfide from manure pits or nitrogen dioxide in silos. Respirators can protect people from these hazards by preventing damage to the respiratory system and harmful exposures that can result in all types of ailments, but only if the right type of respirator is worn and used correctly.

Sometimes, a simple and inexpensive respirator that is worn when needed can prevent permanent lung damage from repeated exposures to common respiratory hazards like grain dust. Other times, such as when working in a manure pit, a higher level of protection will be needed to safeguard against deadly gases or an oxygen-deficient atmosphere.

The Human Respiratory System



True Story: Many Times Before

A 27-year-old farm worker and a co-worker were attempting to remove the pump from a manure holding pit; the holding pit collected the manure that drained from five hog barns on the farm before pumping it into a holding pond 150 feet away. They soon discovered that the pump intake was clogged and positioned a tripod-mounted come-a-long directly over the pit in order to remove the pump for servicing. Using a 3-inch wire rope attached to an eye bolt at the top of the pump, they tried to raise the pump from the pit, however, the wire rope broke.

The next morning, the farm worker found a length of rope with a hook at its end to attach to the pump's eye bolt. As he prepared climb down the ladder into the pit, he was warned by his co-worker that poisonous gases might be present in the pit. The farm worker explained to the co-worker that he had entered the pit many times in the past and that he would be fine.

The farm worker entered the pit and as he reached for the pump, he collapsed and fell into the manure. The co-worker ran to the farm office, called the rescue team and then contacted one of the farm owners (who was also the 27-year-old farm worker's uncle) and told him what had happened. When the farm owner arrived, he entered the pit with a rope to tie around the victim. The co-worker tried to stop the farm owner from entering the manure pit but could not.

The farm owner entered the pit and attempted to tie the rope around the victim. While doing this, he collapsed on top of the farm worker. The rescue team arrived, equipped with self-contained breathing apparatus, and removed both men from the pit. The coroner listed the cause of death for both victims as hydrogen sulfide poisoning.

(Centers for Disease Control and Prevention, 2015)

Atmospheric hazard: A hazard found in the air of a particular place (the atmosphere) that could cause damage to someone or something.

Respirator: A type of personal protective equipment worn by the respirator user that protects them from breathing in airborne contaminants and/or inhaling a hazardous atmosphere.

Respiratory Hazard: Airborne substances or particulates that when breathed in can damage the respiratory tract, cause illness or disease, and even result in death.

Respiratory System: Also called respiratory tract. In humans, it is the system of organs responsible for respiration and consists of the nose, nasal passages, pharynx, larynx, trachea, bronchi, and lungs.

Self-Contained Breathing Apparatus (SCBA): A respirator that has a portable supply of breathing air which is separate from the surrounding atmosphere (the air in the work environment).

RESPIRATORY ILLNESS, DISEASE & FARMING

All too often we fail to respect the hazards that we encounter regularly, especially when it can take years or even decades to recognize the effects of having been exposed to them. The association between respiratory disease and farming has been recognized for a very long time. Listed in the table that follows are several illnesses that can result from things one might come across frequently while working on the farm.

Illness	Cause	Symptoms	Overview
Asthma*	Exposure to an allergen (e.g., pollen, pet dander, mould, etc.) or a non-allergic substance (e.g., grain dust, cleaning products, smoke, etc.)	Wheezing, laboured breathing, cough, tightness in the chest	Response may be immediate and varied, delayed for several hours, or recur for several nights following exposure
Chronic Obstructive Pulmonary Disease (COPD)**	Exposures to organic and inorganic dusts, bacteria, endotoxins, spores and potentially toxic gases, such as ammonia and hydrogen sulfide	Recurring cough, phlegm production for 2+ years, laboured breathing, wheezing	Prolonged exposure to grain dust can result in permanent lung damage, similar to what smokers experience; seen as chronic bronchitis and airway obstruction
Farmer's Lung (Extrinsic Allergic Alveolitis or Hypersensitivity Pneumonitis)*	An allergic disease resulting from inhalation of allergy causing dust, such as hay, straw, corn, silage, or grain	Flu-like symptoms, including cough, fever, chills, laboured breathing, muscle pain and general discomfort	Symptoms start 4 to 8 hours after exposure; small amounts can cause illness after someone has become sensitized; can cause permanent lung damage and death
Inflammation of Air Passages	Exposure to particulates that the immune system considers as a threat	Stuffy nose, runny nose, sore throat, cough, phlegm, laboured breathing	Common reactions are bothersome, but do not result in permanent damage
Silo Filler's Disease*	Occurs when a person inhales nitrogen dioxide, which is produced as silage ferments	Cough, coughing blood, shortness of breath, chest pain, fluid buildup in lungs, long-term lung problems, death	An exposed person may not have symptoms even though lung damage has occurred
Toxic Organic Dust Syndrome (TODS or Grain Fever)*	Heavy exposure to grain dusts and organic dusts; this is especially true when these dusts are confined	Flu-like symptoms, including chills, flushed face, muscle pain, loss of appetite, general body discomfort	Symptoms in new workers occur 4 to 6 hours after exposure or after a few days away

*(Murphy, 2014)

**(Elliot, L., & Essen, S. von., 2016)

A Closer Look at Respiratory Disease & Agriculture

Sources of information relating to respiratory disease in agriculture are relatively limited, however, in the report *Respiratory Disease in Agricultural Workers: Mortality and Morbidity Statistics* by the Centers for Disease Control, the following were noted:

- Individuals whose death certificate indicated they had worked as crop workers had a significantly higher mortality for a number of respiratory conditions, including Farmer's Lung (10 times higher than expected), asthma, bronchitis, histoplasmosis, tuberculosis, pneumonia, and influenza.
- Individuals whose death certificate indicated they had worked as livestock farm workers had a significantly higher mortality for such respiratory conditions as Farmer's Lung (50 times higher than expected), asthma, tuberculosis, and influenza.
- Individuals who reported their longest job held was as a farm worker had an elevated prevalence of phlegm production compared to all non-agricultural workers, and wheezing was found to be higher for female farm workers, as was shortness of breath for farm workers who had "ever smoked."

(Centers for Disease Control and Prevention, 2007.)

Disease	Crop Farm Workers	Livestock Farm Workers
Pulmonary tuberculosis	✓	
Abscess of lung and mediastinum	✓	
Pneumonia, organism unspecified	✓	
Influenza	✓	✓
Asthma	✓	✓
Farmer's Lung	✓	✓

Adapted from the Centers for Disease Control (CDC) Respiratory Disease in Agricultural Workers: Mortality and Morbidity Statistics by Table H-2. Mortality: Diseases with significantly higher proportionate mortality ratios (PMRs) in two or more agricultural groups. (Centers for Disease Control and Prevention, 2007)

DID YOU KNOW?

Facts about Tuberculosis (TB):

- It is caused by a contagious airborne bacteria called Mycobacterium tuberculosis. It primarily attacks the lungs but can affect other parts of the body including the brain, spine, bones, kidneys & lymph nodes. It is curable with antibiotics (Government of Canada, 2023).
- TB is found in every part of the world, including Canada. Individuals born outside of Canada continue to make up the largest proportion of cases in Canada at 76.7%, however high rates continue to be an issue among Canada's Indigenous Peoples, representing 16.9% of TB cases (Government of Canada, 2023).
- Exposure to TB does not mean someone will get sick. It is estimated that one-quarter of the world's population carry the germ (Centers for Disease Control and Prevention, 2024) but most have latent TB; this means that their immune system is protecting them from getting sick. People with latent TB cannot spread the bacteria to others, though a test will indicate an infection present (Centers for Disease Control and Prevention, 2020).
- Most infected people have a 5-15% lifetime risk of getting sick, but should a person's immune system become compromised, the risk will increase (Kiazyk S, Ball, 2017).

Exposure: Being exposed to and unprotected from a hazard.

Particulate: The term particulate refers to very small, separate pieces of matter in either a liquid or solid state. Dusts, fumes, mists (droplets), fibres, fog, pollen, smoke, spores, and bioaerosols are all forms of particulate.

Mediastinum: A space in the chest between the lungs that contains the heart.

MODULE

2

Respiratory Hazards & How to Control Them

In this module, readers will:

1. Be introduced to hazards and different hazard types, with an emphasis on respiratory hazards.
2. Be able to recognize the types of respiratory and atmospheric hazards that may be present on a farm or ranch.
3. Gain an understanding of the Hierarchy of Controls and how to apply it to respiratory and atmospheric hazards.

INTRODUCTION

A hazard is something that could cause damage or harm to someone or something on your farm. Injuries, illness, and other workplace incidents are allowed to happen when the hazards of jobs and tasks are not identified, go unrecognized, or worse, are ignored.

Hazards can be grouped into the following seven categories, and some hazards can belong to more than one of the hazard categories listed below.

1. **Safety hazards** refer to anything that has the potential to cause immediate injury, such as using an unguarded grain auger or driving a truck without fully functioning brakes.
2. **Health hazards** refer to anything that has the potential to cause an acute or chronic condition, illness or disease from exposure, such as working in extremely cold temperatures or working in a poultry barn where ammonia is present for many years.
3. **Chemical hazards** are hazards associated with the storage, handling or use of chemicals. The term chemical refers to a substance or mixture of substances. These substances can potentially cause harm to people, livestock, and the environment.
4. **Biological hazards** are organic substances that can harm someone's health, such as bacteria, viruses, moulds, pollen, body fluids, etc.
5. **Physical hazards** are hazards that pose a threat to someone's physical safety, such as exposure to vibrations, moving parts, exposure to extreme temperatures, etc.
6. **Psychosocial hazards** are those things that can harm someone's mental health and wellbeing. Examples include bullying, harassment, stressful working conditions, and an unsafe working environment.
7. **Ergonomic hazards** are physical factors that may cause musculoskeletal injuries. Examples include sitting or holding the same position for long periods of time, repetitive motions, awkward working positions, excessive force injuries, carrying heavy, awkward and/or moving loads or long hours standing on a hard surface.

Health Hazards and Safety Hazards: A Simpler Approach

It may be helpful to think of the two main categories of hazards as health hazards and safety hazards, however, breaking them out into smaller categories will make it easier to identify more specific hazard types. It is important not to overthink this information, but to simply become familiar with the types of hazards you will need to be aware of and be able to identify while working on the farm.

DID YOU KNOW?

Let's look at grain dust and some of its hazards.

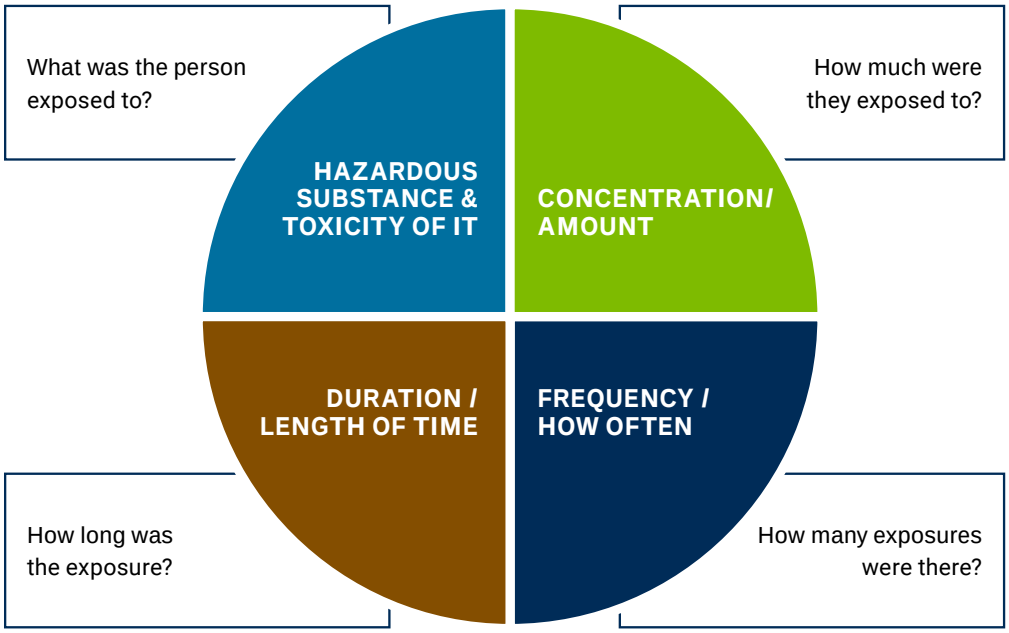
- The dust particles are highly combustible and can result in a fire or explosion under the right conditions.
- Exposure to grain dust can cause itchy skin, skin rashes & conjunctivitis.
- Possible respiratory effects resulting from exposure(s) can include rhinitis, coughing, asthma, chronic bronchitis, chronic obstructive pulmonary disease (COPD), extrinsic allergic alveolitis (Farmer's Lung), and toxic organic dust syndrome (TODS or Grain Fever).

RESOURCE

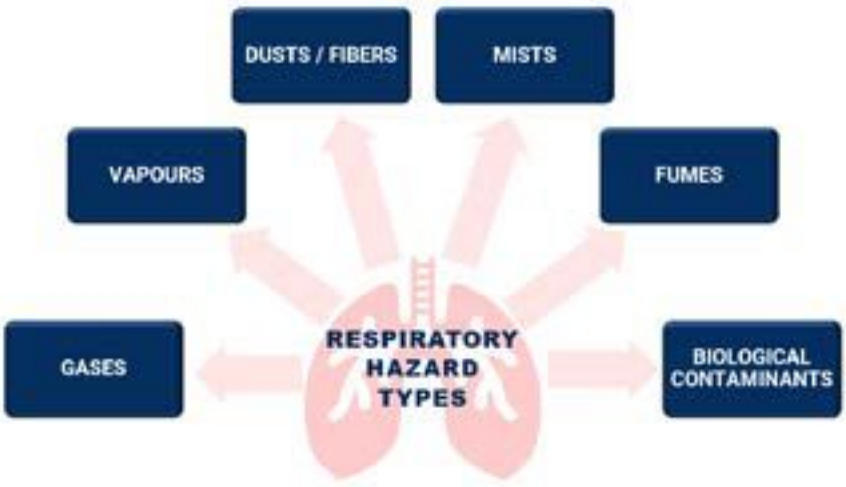
To get a better understanding of hazards and how to control them, refer to the Alberta FarmSafe Plan Manual and the free online AgSafe Alberta FarmSafe Plan Learning Program. Visit **agsafeab.ca** to get started.

RESPIRATORY HAZARDS, ATMOSPHERIC HAZARDS, & IMMEDIATELY DANGEROUS TO LIFE OR HEALTH (IDLH) ENVIRONMENTS

There are many breathing hazards present on farms and ranches. Whether injury, illness or even death results can depend on many factors, such as:



In this section, you will explore some respiratory hazards, atmospheric hazards, and immediately dangerous to life or health (IDLH) environments that can be found on a farm or ranch.



Hazards, Atmospheric Hazards & Hazardous Atmospheres

This module contains a lot of terminology, and it is important to be clear on what these terms mean.

Hazard	Atmospheric Hazard	Hazardous Atmosphere
Something that could cause damage or harm to someone or something.	A hazard found in the air of a particular place (the atmosphere) that could cause damage to someone or something.	An atmosphere, such as the air in a work area, which may expose someone to the risk of death, incapacitation, impairment, injury or acute illness as a result of it being or becoming in some way dangerous to life or health (e.g., flammable, combustible, explosive, toxic, or oxygen deficient). A hazardous atmosphere can have more than one type of atmospheric hazard present in it.

Atmospheric hazard: A hazard found in the air of a particular place (atmosphere) that could cause damage to someone or something.

Hazardous atmosphere: An atmosphere, such as the air in a work area, which may expose someone to the risk of death, incapacitation, impairment, injury or acute illness as a result of it being or becoming in some way dangerous to life or health (e.g., flammable, combustible, explosive, toxic, or oxygen deficient).

Respiratory hazard: Airborne substances or particulates that when breathed in can damage the respiratory tract, cause illness or disease, and even result in death.

Immediately dangerous to life or health atmosphere (IDLH): "An atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere" (Occupational Safety and Health Administration, 2009, p.8).

Gases

Properties

Gases are substances that do not exist as solids or liquids at room temperature. They can be used in a task (e.g., welding) or be produced by some other process occurring on the farm (e.g., composting). Gases can easily spread throughout a building, work area or other type of enclosure. Some gases are heavier than air and will settle in low lying areas, such as pits or trenches. They can be toxic, flammable or explosive.

Health Effects

Gases can have many different health effects and can have more than one type of hazard (e.g., hydrogen sulfide is highly flammable and toxic). Keep in mind that health effects will vary; gases can irritate your eyes, nose, throat, lungs, and skin or enter the bloodstream through the lungs where they can damage organs or body systems.

KEY POINTS TO REMEMBER

Some gases and their sources you may encounter on the farm include:

- *Hydrogen sulfide (H_2S)* from organic materials breaking down in tanks, pits or ponds
- *Ammonia (NH_3)* from organic material being broken down by bacteria
- *Methane (CH_4)* produced by bacteria digesting organic material
- *Carbon monoxide (CO)* from sources of combustion (e.g., engine or furnace)
- *Carbon dioxide (CO_2)* produced by respiration in living organisms and by combustion

Vapours

Properties

Evaporation produces vapours, and vapours are released from products such as pesticides or adhesives. Vapours are the gaseous form of a substance that is normally a liquid or a solid at room temperature and average pressure. Some solids can produce vapours at room temperature, such as mothballs.

Health Effects

The health effects of vapours will vary by product. They can irritate your eyes, nose, throat, lungs, and skin or enter the bloodstream through the lungs and can damage organs or body systems.

KEY POINTS TO REMEMBER

When working with or around vapours, remember:

- Vapours produced by solvents can cause headache, dizziness, confusion, loss of consciousness and even death.
- Vapours that contain carbon are called organic vapours. This includes most pesticides, such as organophosphates.
- When you smell mothballs, you are breathing in insecticide! Mothballs are nearly 100% active ingredient (either naphthalene or paradichlorobenzene). Vapours produced by mothballs can cause anemia as well as damage the liver and kidneys (National Pesticide Information Center, 2023).

Dust and Fibres

Properties

Dusts and fibres are small solid fragments or tiny pieces of something that may or may not be visible to the naked eye. They can be produced mechanically (e.g., by grinding, milling, crushing, cutting, sanding or drilling), naturally by the shedding of skin cells (e.g., animal dander), etc.

Health Effects

Health effects can vary by the type of dust or fibre. Dusts and fibres can irritate the nose, throat and airways. Very small dusts and fibres can become stuck deep in the lungs and may cause serious lung disease, some dusts can cause toxic reactions (organic toxic dust syndrome), allergic reactions (asthma) and chronic illnesses such as chronic obstructive pulmonary disease (COPD) and Farmer's Lung.

Image Source: Central States Center for Agricultural Safety and Health

KEY POINTS TO REMEMBER

When working with or around dusts and fibres, remember:

- Some areas on the farm that may have high dust levels include silos, grain storage bins, hog barns, and poultry barns.
- Common dusts include feed dusts, harvest crop dusts, grain dusts, and wood dusts.

Mists

Properties

Mists are tiny droplets suspended in air that are produced by scattering or distributing a liquid over an area or by condensation (when a vapour or gas changes into a liquid form).

Health Effects

Health effects can vary by product. Certain mists may cause short-term or long-term respiratory illnesses. Some can irritate or even break down exposed tissue (e.g., skin, eyes, airway, and lungs). Others can enter the bloodstream and result in damage to various organs, the nervous system and immune system disorders, fertility problems, birth defects, cancers, etc. (e.g., some pesticide mists).

KEY POINTS TO REMEMBER

Some considerations of mists include:

- Pressurized spray cans of various products can produce mists.
- Non-pressurized fog generators for pesticide application create mists.
- Mists can be produced through spraying and machining processes (e.g., when using cutting fluid while drilling or milling something).

Fumes

Properties

Fumes are very small solid particles suspended in the air. They can be produced not only from the material itself, but the breakdown of any coatings or paints on a material during heating (e.g., welding, soldering, brazing, or cutting fumes).

Health Effects

Health effects can vary by the type of material. Short-term exposure can cause nausea, dizziness or eye, nose, and throat irritation. Prolonged exposure can lead to cancer of the lungs, larynx, and urinary tract as well as damage to the nervous system and kidneys.

KEY POINTS TO REMEMBER

Some consideration of fumes include:

- Welding fumes containing iron, chromium, cobalt, nickel, manganese, molybdenum, vanadium, titanium, etc. are very hazardous to health.
- Fumes can be produced by the heating of paints, oils, rust inhibitors, cutting fluid, etc.

Biological Contaminants

Properties

Airborne biological contaminants can include bacteria (mycobacteria tuberculosis, coxiella burnetti), viruses (hantavirus), mould and mould spores (mycotoxins) as well as plant and animal materials (animal dander, dried feces). Factors that affect the risk associated with biological agents include:

- The type of biological agent
- How it is transmitted
- It's ability to cause disease (pathogenicity)
- Host health factors (e.g., age, pregnancy, etc.)
- The concentration of the agent
- The duration of the exposure
- The type of work activity
- The work practices and procedures

(Centers for Disease Control and Prevention, 2020, p.132-138)

Health Effects

The health effects of biological contaminants can vary significantly. For example, exposure to horse dander may cause a mild allergic reaction in some people and anaphylaxis in others. Similarly, exposure to toxoplasma gondii, a parasite shed in cat feces can become airborne, inhaled, and its effects range from no symptoms to severe toxoplasmosis which can damage the eyes, brain, and other organs.

KEY POINTS TO REMEMBER

Some biological contaminants you may encounter on the farm and their effects include:

- Hantavirus exposures occur when infected mouse urine and droppings become airborne and inhaled. This can happen when someone is vacuuming or sweeping a storage area. Hantavirus usually causes one of two syndromes, Hemorrhagic fever with renal syndrome or Hantavirus pulmonary syndrome. Generally speaking, symptoms may include fever, headache, backache, chills, nausea, vomiting, abdominal pain, cough, shortness of breath, and even death (Spickler and Rovid, 2023, p.1-5).
- Leptospirosis exposures occur when infected urine and feces become airborne and inhaled or through ingestion. Dogs, cattle, sheep, goats, horses, and pigs are commonly infected. Symptoms appear within 7 to 12 days and may include fever, headache, chills, severe leg myalgia, conjunctival injection, jaundice, aseptic meningitis, cough, dyspnea, acute renal failure, or abortion (Spickler, et al., 2023, p.1-6).

DID YOU KNOW?

The term *contaminant* means any physical, chemical, biological or radiological substance or matter that may be harmful to humans or other living organisms.

RESOURCE

AgSafe Alberta has developed a Workplace Hazardous Materials Information System (WHMIS), Pesticide, Veterinary Drug and Medicated Feed Awareness Manual and supporting online course specifically for Alberta farmers and ranchers. Visit **agsafeab.ca** to get started.

Oxygen Deficiency

Properties

The normal air around us contains almost 21% oxygen. Air that contains less than 19.5% oxygen is called oxygen deficient.

Health Effects

Low levels of oxygen can cause poor judgment, lack of coordination, behaviour changes, dizziness, fatigue and ultimately collapse and death.

KEY POINTS TO REMEMBER

Some causes and considerations of an oxygen deficient environment include:

- Rusting metal (rusting is an oxidation process that uses up the available oxygen)
- Combustion (all sources of combustion consume oxygen)
- Displacement by other gases (such as welding gases, leaking gas lines or carbon monoxide build up from incomplete combustion)
- Rotting of organic matter (micro-organisms consume oxygen and produce flammable methane gas that can also displace oxygen)

Signs and Symptoms of Oxygen Deficiency

The percentage of oxygen in the air can have varying effects on individuals. The table below shows general symptoms that are associated with the different oxygen levels.

Percentage of Oxygen in the Air	Possible Symptoms
Normal oxygen concentration 20%	Exposure to an allergen (e.g., pollen, pet dander, mould, etc.) or a non-allergic substance (e.g., grain dust, cleaning products, smoke, etc.)
19%	Some effects, if at rest, may go unnoticed. Any form of physical work can result in a worsening of symptoms.
15 to 19%	Increased heart and breathing rate. Impaired thinking & decision making. Decreased coordination. Physical and mental performance are decreased, but the person is unaware of this.
12 to 15%	Abnormal fatigue if performing work. Emotional upset, poor coordination, and poor judgment occurs.
10 to 12%	Very poor judgement & coordination. Nausea, vomiting and fainting can occur within minutes and without warning. Breathing rate becomes so low that it may cause permanent heart damage.
Less than 10%	Inability to move. Fainting will occur almost immediately. A loss of consciousness, convulsions and death can occur.

(Air Products and Chemicals, Inc., n.d., p.2)

DID YOU KNOW?

Hypoxia is the term used when there is not enough oxygen reaching the tissues in someone's body (low blood oxygen).

Airborne: Something that is suspended in or carried by the air.

Biological contaminant: Bacteria, moulds, mould spores, pollens, viruses, and other biological materials that are polluting or poisonous in some way.

Contaminant: Any physical, chemical, biological or radiological substance or matter that may be harmful to humans or other living organisms, such as a gas, vapour, liquid, or solid material that is not normally found in the air or is normally found only in small, acceptable amounts. These materials have known toxic properties or other negative health effects.

Dust: Small solid fragments or tiny pieces of something that may or may not be visible to the naked eye.

Fibre: A small solid fragment or tiny piece of something with a threadlike or elongated shape that may or may not be visible to the naked eye.

Fume: Very fine, solid particles that are suspended in air, such as in smoke, vapour or gas.

Gas: A gas is a substance that does not exist as a solid or liquid at room temperature.

Hypoxia: : The term used when there is not enough oxygen reaching the tissues in someone's body (low blood oxygen).

Mist: Tiny droplets suspended in air that are produced by scattering or distributing a liquid over an area or by condensation (when a vapour or gas changes into a liquid form).

Toxic: Poisonous or harmful.

Vapour: The gaseous form of a substance that is normally a liquid or a solid at room temperature.

Immediately Dangerous to Life or Health (IDLH) Environments

Immediately Dangerous to Life or Health (IDLH) is a term that may not mean much to you now, but after reading this section it should. IDLH environments are more common on farms than many realize, and quite often the conditions exist where these types of environments can develop without someone recognizing it. Many of the hazards that you just read about can result in an environment being considered IDLH.

The term IDLH can be explained in more than one way, and below are some examples.

Alberta Occupational Health and Safety legislation defines IDLH as:
"Immediately dangerous to life or health" means circumstances in which the atmosphere is deficient in oxygen or the concentration of a harmful substance in the atmosphere

a) is an immediate threat to life,

b) may affect health irreversibly,

c) may have future adverse effects on health, or

d) may interfere with a worker's ability to escape from a dangerous atmosphere."

(Occupational Health and Safety Code, Statutes of Alberta 2021, s.1)

WorkSafe BC gives us another way to think about IDLH conditions:

a) Where there is known toxin or chemical in the air at a concentration known to be IDLH

b) Where there is a known toxin or chemical in the air and the concentration is not known or has the potential to be IDLH

c) A confined space where the air has not been tested for toxins, chemicals, oxygen levels, etc.

d) Any place where the air is oxygen deficient

e) Firefighting activities

f) Any place where toxins or chemicals in the air are above 20% of their lower explosive limit (LEL)

(adapted from WorkSafe BC, 2011, p.9)

DID YOU KNOW?

Some examples of where IDLH atmospheres may be found on farms include:

- Silage bunkers and silos where high levels of carbon dioxide can displace oxygen resulting in an oxygen deficient atmosphere and the presence of highly toxic silage gases, such as nitrogen dioxide (NO_2).
- Humane poultry depopulation in a barn, modified-atmosphere killing (MAK) unit or sea container using carbon dioxide (CO_2).
- Manure pits or lagoons where hydrogen sulfide (H_2S), methane (CH_4), and an oxygen deficient atmosphere can exist.

IMPORTANT

Atmospheres that are or may become explosive would be considered IDLH. These atmospheres would require *intrinsically safe* equipment to be used, such as an intrinsically safe respirator or gas monitor. The term intrinsically safe simply means that the equipment has been certified as not being a source of ignition.

IDLH Conditions, Confined Spaces & Restricted Spaces

IDLH conditions and confined spaces can frequently be found together, and similar to IDLH conditions, confined spaces are common on farms yet are often unrecognized. In order to identify a confined space, you will first need to know what a restricted space is.

Restricted Spaces

A restricted space is a work area that:

- Is not meant to have someone in it all of the time or even very often.
- Would be big enough to enter and difficult to get in or out of.
- Would not have any other hazards or have the hazards properly controlled.

Think of a space with a small entry way or with obstructions that would make passage or moving around inside of it hard. An example of a restricted space may be the attic of a house, where the access ladder and hatch would make it difficult to go into and leave the space but would pose no other threat to someone's health or safety while being in it.

(Occupational Health and Safety Code, Statutes of Alberta 2023, s.1)

Confined Spaces

A confined space is a restricted space which is hazardous, or may become hazardous, to a person entering it because of:

- An atmosphere that has too little or too much oxygen, is flammable, explosive or toxic (e.g., silo gases in a silage bunker).
- A condition or changing set of events that may cause illness or injury (e.g., someone inside a grain bin and someone outside turns on the auger).
- The potential for an activity to produce dangerous or harmful results in the space (e.g., using a harsh cleaning product in the confined space may allow toxic fumes to build up).
- The basic characteristics of an activity that can produce dangerous or harmful results in the space (e.g., welding in a confined space).

(Occupational Health and Safety Code, Statutes of Alberta 2023, s.1)

Examples of Confined Spaces in Agriculture

Read the examples below and think about where you would find some of the hazards that you learned about earlier.

- Grain and feed storage facilities
- Corrugated steel bins
- Silos
- Tunnels (e.g. conveyor tunnel)
- Bulk liquid storage tanks
- Fermentation vessels
- Feed mixer wagons/tanks
- Grain driers
- Composting ponds
- Pump sheds
- Trenches and open ditches
- Sumps, tunnels, and pump pits
- Forage storage
- Wells, cisterns, dry wells
- Fuel storage tanks
- Sea cans
- Feed grinders/mixers
- Culverts
- Root cellars
- Manure storage tanks
- Manure/bio-digester units
- Manure transport vehicles (tanks and applicators)
- Storage and mixing tanks, bins and silos
- Climate controlled plant storage units
- Sprayer and chemical transport vehicles
- Containment areas around diked storage tanks
- Forage and silage dump wagons
- Septic tanks
- Manure or silage pits
- Bunkers
- Grain wagons
- Dump pits

(adapted from Occupational Safety and Health Administration, 2018, p. 1-2)

True Story: Scary Silage

A 39-year-old farmer was briefly exposed to silo (silage) gas. While upright silos often come to mind, these gases are also produced in silage bunkers, piles, and bags. Several hours after being exposed, he started experiencing labored breathing and a cough that was producing dark coloured mucus. He was admitted to hospital three days later; his cough had become dry, he had a temperature of 39°C, a rapid heartbeat, and a white blood cell count of 20,000 (anything above 11,000 is considered high).

The farmer was diagnosed with Silo Filler's Disease, a preventable disease that results in acute lung injury from breathing in toxic levels of nitrogen dioxide (NO_2) present in silo gas.

While the exposure was brief and the farmer lived, it is not known if treatment was received soon enough to prevent any irreversible scarring of the lungs or disabling airflow obstruction.

(Auron, M. et al, 2011)

Acute: Of sudden onset, lasting a short time or requiring short-term medical care.

Confined space: "A restricted space which may become hazardous to a worker entering it because of (a) an atmosphere that is or may be injurious by reason of oxygen deficiency or enrichment, flammability, explosivity or toxicity, (b) a condition or changing set of circumstances within the space that presents a potential for injury or illness, or (c) the potential or inherent characteristics of an activity which can produce adverse or harmful consequences within the space (Occupational Health and Safety Code, Statutes of Alberta 2021, s.1)."

Hypoxia: The term used when there is not enough oxygen reaching the tissues in someone's body (low blood oxygen).

Immediately dangerous to life or health atmosphere (IDLH): "Circumstances in which the atmosphere is deficient in oxygen or the concentration of a harmful substance in the atmosphere (a) is an immediate threat to life, (b) may affect health irreversibly, (c) may have future adverse effects on health, or (d) may interfere with a worker's ability to escape from a dangerous atmosphere (Occupational Health and Safety Code, Statutes of Alberta 2021, s.1)."

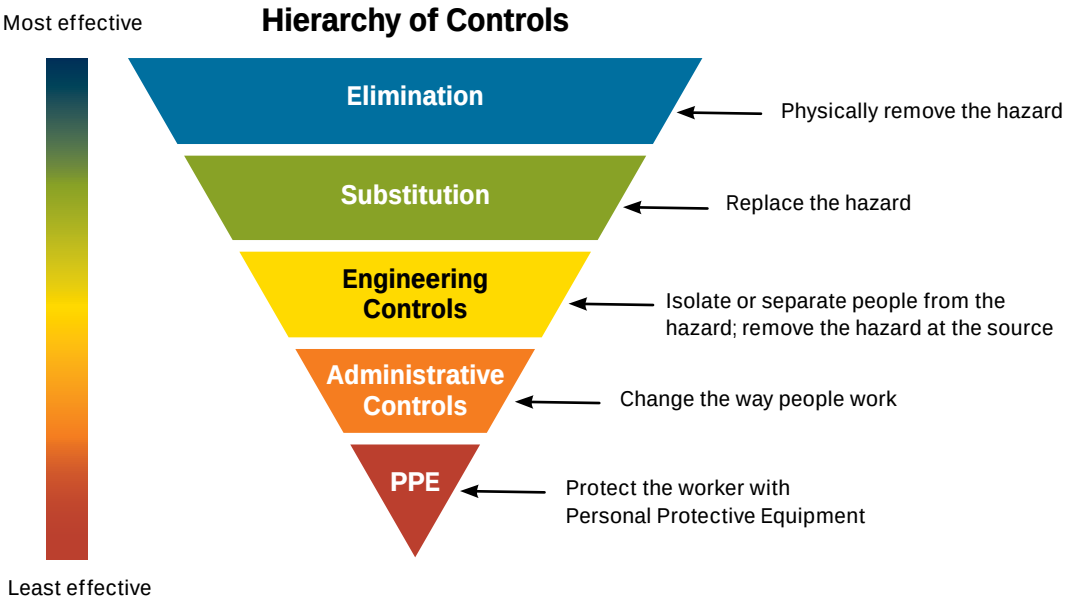
Intrinsically safe: Tools or equipment that have been certified as not being a source of ignition.

Oxygen Deficient Environment: An environment or workspace with air that contains less than 19.5% oxygen.

Restricted space: A work area that is not meant to have someone in it all of the time or even very often, would be big enough to enter and difficult to get in or out of, and would not have any other hazards or have the hazards properly controlled (Occupational Health and Safety Code, Statutes of Alberta 2021, s.1).

Controlling Respiratory Hazards Using the Hierarchy of Controls

Most breathing hazards can be reduced or even eliminated by working through the hierarchy of controls and putting reasonable, practical control measures in place. Before moving on, let's quickly review the hierarchy of controls.



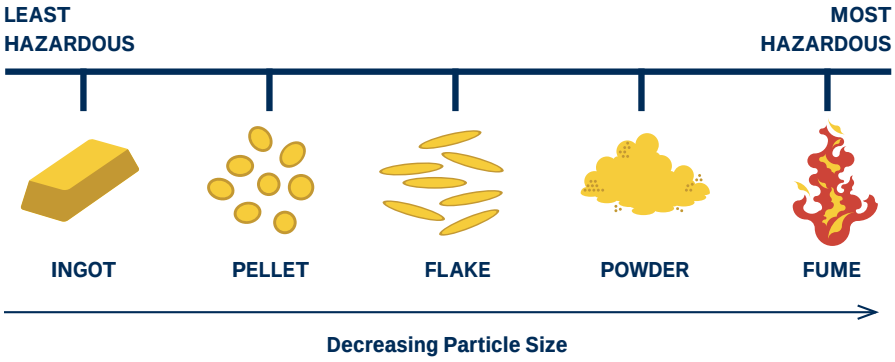
(adapted from NIOSH, n.d.)

Elimination

Elimination is where the hazard is removed from the job, task or work environment completely. This should be done wherever possible, as it is the best way to ensure that no one and nothing will be harmed by it. An example of this would include changing the work process so that a toxic chemical is no longer used.

Substitution

Substitution is where a hazard or the source of the hazard is replaced with something less harmful. This could include using a less harmful chemical for cleaning a barn or using a pesticide that comes in pellet form rather than a dust form to reduce the risk of breathing it in.



Engineering Controls

Engineering controls are used to isolate or separate workers from the hazard or to remove the hazard at the source before a worker can come into contact with it. Examples of this would include installing a local exhaust ventilation (LEV) system to capture welding fumes at or near the arc or installing a ventilation system in a barn to move fresh air in and keep ammonia levels down.

Administrative Controls

Administrative controls change the way people work and involve developing a method or standard way of doing things that minimizes the hazard. Examples of administrative controls include developing procedures and safe work practices for the jobs and tasks that are performed, training people how to perform jobs and tasks and posting signs to help make people in an area aware of the hazard(s) present.

Personal Protective Equipment (PPE)

Personal protective equipment (PPE) is anything worn by someone to reduce their exposure to a hazard. Respiratory protective equipment (e.g., respirators) are an example of PPE.

Administrative control: These controls change the way people work and involve developing a method or standard way of doing things that minimizes the hazard.

Elimination: Where the hazard is removed from the job, task or work environment.

Engineering control: Methods to isolate or separate workers from the hazard or to remove the hazard at the source before a worker can come into contact with it.

Hazard: Something that could cause damage or harm to someone or something on your farm.

Hazard control: An action or actions taken to eliminate or minimize the risk of injury, illness or damage.

Hazard elimination: Removing a hazard from the workplace. The most effective and reliable means of addressing a hazard; should be used whenever possible.

Hierarchy of Controls: A system for controlling risks in the workplace where risk controls are ranked from the highest level of protection and reliability through to the lowest and least reliable level of protection.

Personal protective equipment (PPE): Anything worn by someone to reduce their exposure to a hazard.

Substitution: Where a hazard or the source of the hazard is replaced with something less harmful.

Ventilation: A means of moving fresh air into an area or removing contaminated or stale air from an area.

Hazard Elimination & Control Summary

The most effective hazard control measures are those that do not rely on a person's actions or behaviors.

MOST EFFECTIVE	**Elimination and Substitution**	Removes the hazard	Caution: The hazard can be reintroduced in processes, services and workplaces.
	Engineering Controls	Changes the work environment	Caution: Can sometimes be disabled, removed or ignored.
	Administrative Controls	Changes the way people work	Caution: These rely on the behaviours and actions of people.
LEAST EFFECTIVE	**Personal Protective Equipment (PPE)**	Reduces the hazard	Caution: These rely on the effectiveness of the PPE, the user's training, and their actions.

More Than One Type of Hazard Control May Be Needed

Eliminating the hazard should always be considered first, however, it is not always possible. Quite often, more than one type of hazard control will be needed to reduce the hazard to a reasonable level. Consider people who spend long hours in a livestock barn where the air quality can be hazardous due to contaminants like dusts and ammonia. The source of the contaminants cannot be eliminated (e.g., the animals). In an effort to reduce the hazards of these contaminants, the farm might decide to do the following:

- Change from a dry feed to a wet feed in order to reduce airborne endotoxin concentrations (an example of substitution).
- Install a mechanical ventilation system (an engineering control).
- Develop standards to ensure the barn's stocking density does not exceed the ventilation system's capacity to maintain reasonable air quality (an administrative control).
- Require everyone who works in the barn to be trained in the use, care, and maintenance of a reusable respirator with combination cartridges (an administrative control).
- Require everyone who works in the barn to wear their reusable respirator with the correct type of combination cartridges (a form of PPE attached to a reusable respirator that protects the person from both dust particles and ammonia).

Respiratory Protective Equipment Should Not Be The First Choice

What this means is that respiratory protective equipment should not be the first choice for respiratory protection under normal circumstances.

Respiratory protective equipment should only be used when:

- Substitution, engineering controls and administrative controls are not realistic or possible; for example, this could be a temporary condition that has become present, or a one-time task is occurring.
- Substitution, engineering controls and administrative controls cannot reduce the hazard to an acceptable, safe level.
- Engineering control methods are being installed or repaired.
- An emergency situation has occurred.

(adapted from Canadian Centre for Occupational Health and Safety, 2024)

AN INTRODUCTION TO IDENTIFYING, TESTING, AND MONITORING HAZARDOUS ATMOSPHERES

In order to know if your farm will need to use gas monitors, you must first perform thorough, farm-specific hazard assessments to identify where and when toxic, explosive, or oxygen deficient environments exist or could potentially exist.

Once the hazard assessments are completed, you will need to evaluate the risks to determine which gases you'll need to test and monitor for. Testing and monitoring are critical, as they protect the health and safety of your farm team.

Personal gas monitors are a type of personal protective equipment. This means that it is the least effective of all the hazard controls measures and is only selected after all other hazard control measures have been considered, and those measures found to be appropriate have been put into place. All forms of personal protective equipment should only be used as a last resort and must always be used in combination with other hazard control methods.

If the farm finds that the use of personal gas monitors are required, it will need to develop a policy for when personal gas monitors will be used, what types of servicing or maintenance will be performed, what type of training is needed to use one, what type of recordkeeping will need to occur, etc. The farm will also need to create procedures for things like the general use, calibration and bump testing of the specific personal gas monitors it uses.

KEY POINTS TO REMEMBER

- To identify when an atmosphere has toxic gases present, not enough oxygen (oxygen deficient), or has too much oxygen (risk of fire or explosion), the correct type of gas detection equipment will need to be used. What a monitor detects, how it detects it, how it is used, how it is maintained and the cost of one can vary greatly.
- Selecting the right type of gas detection monitor is critical to working safely and should be done by someone who is qualified to do so.

RESOURCE

Refer to **Appendix H: Gas Monitors** in this manual to learn more about the types of gas monitors and gain an understanding of how they are used.

MODULE

3

Understanding Respirators

In this module, readers will:

1. Learn about air-purifying respirators (APRs) and supplied-air respirators (SARs).

2. Learn the differences between face masks & respirators, and why that difference matters.

3. Gain a general understanding of the different types of respirators, their uses & limitations.

INTRODUCTION

A respirator is a type of personal protective equipment worn by a person that protects them from breathing in airborne contaminants and/or inhaling a hazardous atmosphere. Respirators must be approved by the National Institute for Occupational Safety and Health (NIOSH), or another comparable organization approved by Alberta Labour (Occupational Health and Safety Code, Statutes of Alberta 2021, s.246(a)-(b)).

All NIOSH-approved respirators have an approval number, and it will always start with the letter "TC." The approval number can be found on the respirator itself, or it may be found on or within the packaging.

Example

TC Approval Number
TC-84A-XXXX

Both an approval number and user instructions are provided with all NIOSH-approved respirators. NIOSH also has an email notification service. A respirator user or farm may subscribe to receive User Notice email notifications concerning approvals, other relevant information, and alerts when an approval has been revoked.

Look at the following diagram to see the NIOSH markings on an N95 respirator:

APPROVAL HOLDER

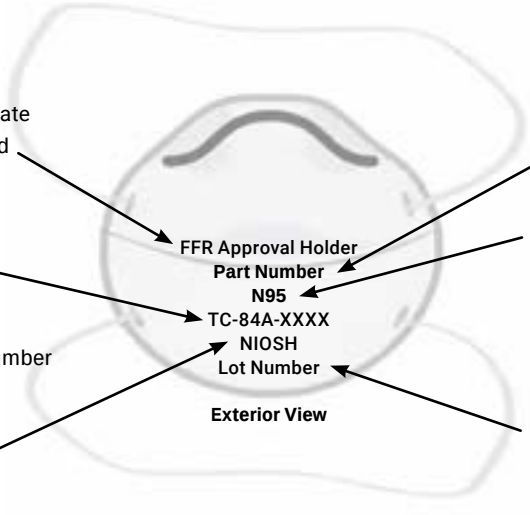
Name or logo of approval holder (company). If private labeled, the private label name or logo will appear instead of the approval holder information.

TC-APPROVAL NUMBER (TC-84A-XXXX)

For products manufactured after September 2008, the TC Approval Number is required to appear on the product.

NIOSH

NIOSH in capital block letters.



MODEL OR PART # XXXX

PROTECTION

NIOSH filter series. Alpha-numerical rating followed by filter efficiency level (example, N95, N99, N100, R95, R99, P95, P99, P100). Also Surgical N95 (when applicable).

LOT # XXXX

Recommended but not required.

(National Institute for Occupational Safety and Health, 2021))

DID YOU KNOW?

Surgical masks are not respirators.
Surgical masks are loose fitting devices that help prevent large droplets from being spread by the person wearing them and can help catch large droplets from splashes or sprays in the work environment. Some surgical masks have been approved by regulatory bodies, which means that they have been tested for their ability to resist splashes of blood and other body fluids.

IMPORTANT

- Face masks (dust masks, surgical masks, and cloth masks) are not designed to fit a person's face tightly or seal against it. This allows contaminants to enter the area between the user's face and the mask, allowing them to be breathed in. Face masks also do not prevent small airborne contaminants from passing though the mask material and entering the user's respiratory system.
- Respirators & face masks can carry bacteria... especially when they are not used, handled, or disposed of properly. The transfer of harmful bacteria to and from respirators & face masks can be a potential risk to the health of the person wearing them as well as others in the work environment.

WHAT IS NOT A RESPIRATOR?

Dust Mask

Surgical Mask

Cloth Mask

Assigned Protection Factor (APF)

Respirators are given a number called an assigned protection factor. This number represents the expected level of respiratory protection that would be provided by a properly functioning respirator when fitted to and used by someone who is both trained and competent. It is used to help select the right type of respirator for the level of contamination present.
A respirator with a higher number will provide more protection than one with a lower number. It is important to note that assigned protection factors do not apply to escape respirators.

(Occupational Safety and Health Administration, 2009, p.3)

Types of Respirators

The two types of respirators that we will focus on are air-purifying respirators and air-supplying respirators.

AIR-PURIFYING RESPIRATORS (APRs)	SUPPLIED-AIR RESPIRATORS (SARs)
	
Air-purifying respirators remove contaminants from the air.	Supplied-air respirators, also called air supplying respirators, provide clean air from an uncontaminated source.

What Is a Facepiece on a Respirator?

The term facepiece is used often in this manual, so it is important to know what one is. The facepiece of a respirator is essentially the part that covers the nose and mouth of the respirator user. As you will learn, the facepiece of a respirator may only cover the nose and mouth of the person wearing it, or it may cover the nose, mouth and eyes. Facepieces may also be tight-fitting or loose-fitting, depending on the type of respirator.

Positive Pressure & Negative Pressure Respirators

As you learn more about the different types of respirators, you will need to understand the difference between a positive pressure respirator and a negative pressure respirator.

A positive pressure respirator is a respirator that maintains a positive pressure in facepiece or hood in relation to the air pressure outside of the facepiece or hood both during inhalation and exhalation. It may be helpful to think of the clean air that the respirator user is breathing as being pushed into the facepiece of the respirator. Pressure-demand and continuous-flow supplied-air respirators are types of positive pressure respirators. An example of this would be a positive pressure full-facepiece SCBA.

A negative pressure respirator is a tight-fitting respirator where the air pressure in the facepiece is negative in relation to the air pressure outside of the respirator during inhalation. An example of a negative pressure respirator would be a tight-fitting filtering-facepiece respirator (such as an N95 respirator) when the respirator user is breathing in.

You may come across other terms being used that relate to positive and negative pressure respirators. These terms can be found in the table below.

Respirator Type	Pressure Type	Explanation
Pressure-demand supplied-air respirator	Positive pressure respirator	Provides air to the wearer based on their breathing, however, it keeps the pressure inside the facepiece positive during use (during both inhalation and exhalation).
Continuous-flow supplied-air respirator	Positive pressure respirator	Maintains constant airflow into the facepiece, resulting in positive pressure.
Demand respirator	Negative pressure respirator	Provides air to the person wearing it based on their breathing and will have negative pressure in the facepiece during inhalation.

(National Institute for Occupational Safety and Health, 2019, p.1-3)

Assigned Protection Factor (APF): The expected level of respiratory protection that would be provided by a properly fitted and functioning respirator being used by a competent person.

Continuous-flow supplied-air respirator: A type of positive pressure respirator that maintains constant airflow into the facepiece.

Demand respirator: A negative pressure respirator; a respirator that will have negative pressure in the facepiece during inhalation.

Face mask: A loose-fitting mask that covers the nose and mouth and is worn to help prevent large droplets from being spread.

Facepiece: The part of the respirator that covers the nose and mouth of the respirator user.

National Institute for Occupational Safety and Health (NIOSH): The United States federal research agency focused on researching worker health and safety and making recommendations for the prevention of workplace injury and illness.

Negative pressure respirator: A tight-fitting respirator where the air pressure in the facepiece is negative in relation to the air pressure outside of the respirator during inhalation.

Pressure-demand supplied-air respirator): A type of positive pressure respirator that provides air to the wearer based on their breathing; it keeps the pressure inside the facepiece positive during use (during both inhalation and exhalation).

Supplied-air respirator: A type of respirator that provides clean air from an uncontaminated source.

Surgical mask: A type of face mask that covers the nose and mouth of the wearer to help prevent large droplets from being spread.

AIR-PURIFYING RESPIRATORS (APRs)

Air-purifying respirators can remove contaminants from the air you breathe by filtering out particulates, such as dusts, fumes, mists, etc., using a filter and/or can absorb gases or vapours using an adsorbing material in a cartridge or canister. While there are different kinds of air-purifying respirators, the types you will commonly see are the tight-fitting half-facepiece respirator that covers from the nose to below the chin, and the tight-fitting full-facepiece respirator that covers the face from above the eyes to below the chin.

Air-purifying respirators can be powered air-purifying respirators (battery powered devices that pull air through the filters) or they can be non-powered air-purifying respirators (where the respirator user drawing breath pulls air through the filter(s)). Types of air-purifying respirators include:

			
Particulate Respirators May also be called dust, fume, and mist respirators.	**Chemical Cartridge Respirators** Can be combination chemical cartridges with a particulate pre-filter.	**Gas Masks** Contain more adsorbent than cartridge-type respirators and can provide a higher level of protection than chemical cartridge respirators.	**Powered Air-Purifying Respirators (PAPRs)** Use a battery powered blower to draw air through the filter or cartridge.

(Adapted from Canadian Centre for Occupational Health and Safety, 2018)

NOTE

The next module will cover cartridges, canisters and filters in detail.

Adsorbent: A material capable of collecting molecules of gases or solutions that they come not contact with on their external or internal surface.

Chemical cartridge respirators: See also the term *Gas mask*. A type of air-purifying respirator that filters or cleans chemical gases and possibly particles out of the air that is breathed in (National Institute for Occupational Safety and Health, 2020). May also be equipped with a particulate filter.

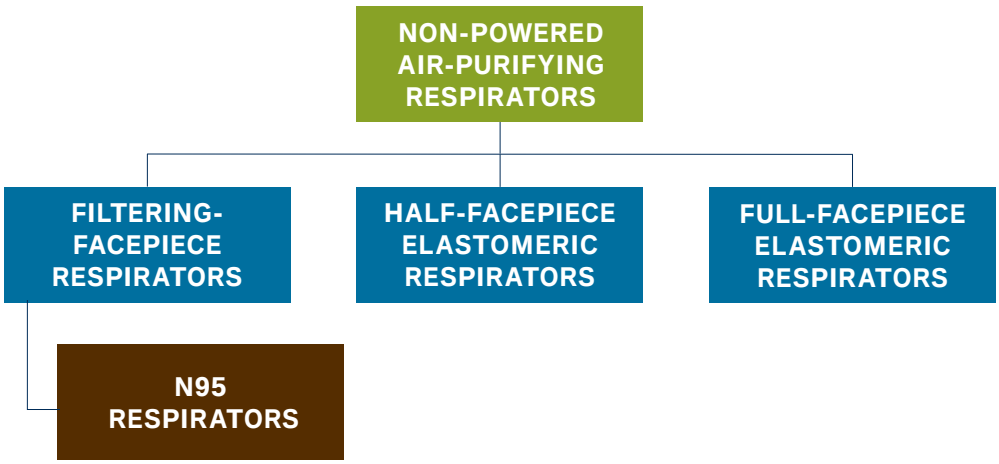
Gas masks: 1. A type of air-purifying respirator that filters or cleans chemical gases and possibly particles out of the air that is breathed in (National Institute for Occupational Safety and Health, 2020). 2. A type of air-purifying, chemical cartridge (or canister) respirator that contains more adsorbent than a cartridge-type respirator and can provide a higher level of protection as result of this.

Particulate: Very small, separate pieces of matter in either a liquid or solid state. Dusts, fumes, mists (droplets), fibres, fog, pollen, smoke, spores, and bioaerosols are all forms of particulate.

Particulate respirator: A type of air-purifying respirator that filters out particles only, such as dusts fumes and mists.

Powered air-purifying respirators: Respirators equipped with battery powered devices that pull air through the filters.

Types of Non-Powered Air-Purifying Respirators



Filtering Facepiece Respirator

This type of respirator uses the entire facepiece to filter the air being breathed in by the respirator user. Some types may have an *elastomeric* (rubber-like) seal where the respirator contacts the face. These respirators will have two straps that secure the respirator in place above and below the ears. They are designed for single use only and must be disposed of once the *service life*, or acceptable use period, is reached. There are nine classes of filtering facepiece respirators which are listed in the table below.

Classes of Filtering Facepiece Respirators

N95 Respirator	Filters at least 95% of airborne particles	Not resistant to oil
N99 Respirator	Filters at least 99% of airborne particles	Not resistant to oil
N100 Respirator	Filters at least 99.7% of airborne particles	Not resistant to oil
R95 Respirator	Filters at least 95% of airborne particles	Somewhat resistant to oil
R99 Respirator	Filters at least 99% of airborne particles	Somewhat resistant to oil
R100 Respirator	Filters at least 99.7% of airborne particles	Somewhat resistant to oil
P95 Respirator	Filters at least 95% of airborne particles	Strongly resistant to oil
P99 Respirator	Filters at least 99% of airborne particles	Strongly resistant to oil
P100 Respirator	Filters at least 99.7% of airborne particles	Strongly resistant to oil

N95 Respirators

N95 respirators are designed to fit the face closely. The edges of the respirator form a tight seal around the nose and mouth, and efficiently filter out airborne particles as air is drawn through the filter material. Models that have exhalation valves can help make the respirator more comfortable by reducing the heat build-up in it but should not be used in areas that must be kept sterile.

It is important to remember that N95 respirators are labeled 'single-use.' If your N95 respirator becomes soiled, is damaged, or breathing becomes difficult, you should remove it and replace it with a new one.

IMPORTANT

Nuisance Dust Masks

Nuisance dust masks are not respirators. While they may offer some protection from very large particles, they do not protect the person wearing one from small particles that may travel deeply into the lungs and result in respiratory distress, illness, or disease.

Half-Facepiece Elastomeric Respirators

A half-facepiece elastomeric respirator is made of a pliable silicone or latex face piece that covers from the nose to below the chin. It is designed to be reusable, which means that the filters or cartridges can be replaced as can other parts of it, such as valves and head harnesses depending on the manufacturer. As these are reusable, it is important that they are handled, stored, maintained, and cleaned regularly as directed by the manufacturer.

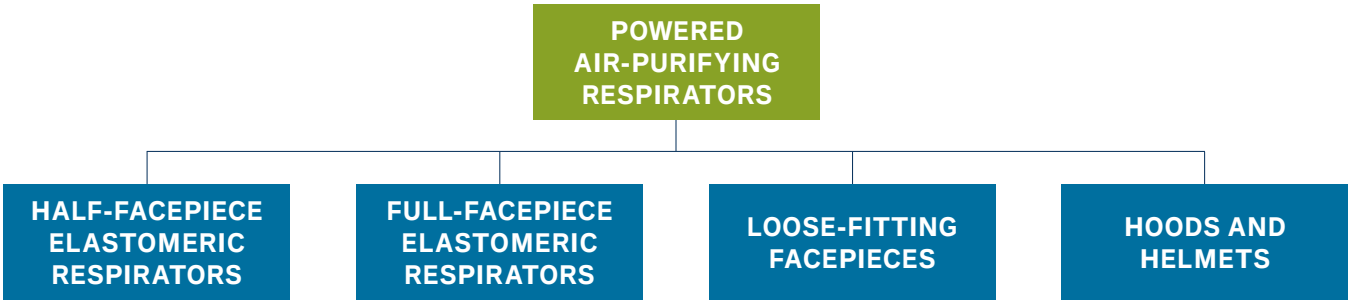
Full-Facepiece Elastomeric Respirators

An elastomeric full-facepiece respirator covers the face from above the eyes to below the chin. Where it seals against the face is commonly made of silicone or natural rubber. It has a large plastic lens that covers the face and provides a degree of eye protection. This type of respirator is reusable, making it essential that it is handled, stored, maintained, and cleaned regularly as directed by the manufacturer.

IMPORTANT

A full-facepiece respirator can provide a degree of eye protection; however, it will require special inserts if the respirator user wears glasses to ensure that the face seal is not broken.

Types of Powered Air-Purifying Respirators



Powered air-purifying respirators (PAPRs) use a battery powered blower to draw air through the filter or cartridge. The benefits of this type of respirator include requiring less effort from the user to breath and that they are more comfortable to wear than non-powered air-purifying respirators. Styles of powered air-purifying respirators include half-facepiece respirators, full-facepiece respirators, loose-fitting facepieces, hoods and helmets.

While the half-facepiece and full-facepiece respirators require a tight seal against the face, the loose-fitting type may be worn with some degree of facial hair and glasses. This type of respirator is also generally more protective than non-powered air-purifying respirators due to the fact it creates positive pressure inside the facepiece which helps to reduce the likelihood of contaminated air leaking inside of it.

KEY POINT TO REMEMBER

Alterations, modifications, improvisations, interchanging respirator parts from another model (or brand) or failing to use respirator parts can all void the respirators NIOSH approval and result in the respirator not protecting you. Always refer to the manufacturer's specifications.

IMPORTANT

- **The level of protection provided by the different types of respirators will vary**, so careful consideration must be given to the hazards and use within the workplace.
- **Never use an air-purifying respirator in an oxygen-deficient atmosphere** as they are designed to only clean the air and do not add oxygen to it. Oxygen-deficient atmospheres require supplied-air respirators and special training before entering such an area.

Air-purifying respirators (APRs): A type of respirator that removes contaminants from the air being breathed in by filtering out particulates and/or absorbing gases or vapours.

Elastomeric: Rubber-like; it is a natural or synthetic material that has elastic properties.

Powered air-purifying respirators (PAPRs): A type of respirator that uses a battery powered blower to draw air through the filter or cartridge.

Positive pressure: "Refers to pressure-demand mode or continuous-flow mode respirators (Alberta Government, 2020, p.4)". "A respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator (OSHA, 2009, p.8).

Service life: The acceptable period of use in service or the expected lifetime of the respiratory protective equipment where it will provide adequate protection to the respirator user.

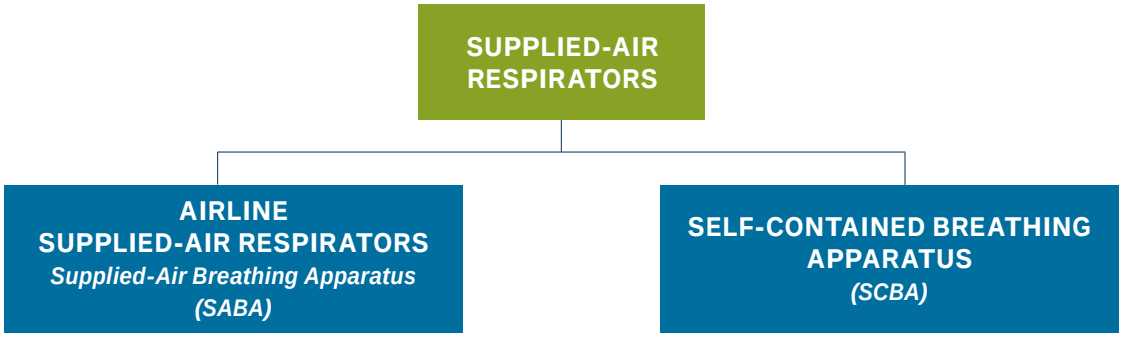
Single-use: Designed to be used only once and then disposed of properly.

Supplied-air respirators (SARs): A type of respirator that provides clean air from an uncontaminated source.

SUPPLIED-AIR RESPIRATORS (SARs)

Supplied-air respirators provide the user with clean breathing air from a compressed air tank or an airline and do not clean or filter the air. This type of respirator is typically used to protect workers from high levels of contaminants, highly toxic contaminants, contaminants with poor warning properties and where a cartridge or filter may not be able to effectively remove the contaminant. Supplied-air respirators are the only type of respirator that may be used in IDLH atmospheres, which includes oxygen deficient atmospheres.

The types of air-supplying respirators we will cover include:



Air-supplying respirators are complex systems with additional factors that need to be taken into consideration before use. Anyone using this type of respirator will require a higher level of training not covered here.

Practical experience is especially important and can typically be obtained through in-person training. Confined space and hydrogen sulfide (H_2S) training courses both typically offer this type of hands-on experience and can often be taken from a provider in your area.

The two most common types of supplied-air respirators in workplaces are pressure-demand or positive pressure respirators and continuous flow respirators. These are looked at in more detail shortly.

DID YOU KNOW?

When air is supplied by a tank or compressor, it must meet certain standards for purity and moisture content. These standards are outlined in the CSA Standard Z180.1-13 *Compressed Breathing Air and Systems*.

Airline Supplied-Air Respirators

An airline supplied-air respirator is connected to a separate source that provides clean air through a hose called an airline. The source that supplies the air may be a high-pressure system, such as a compressor or compressed air cylinder, or a low-pressure system with a pump. It is important to remember that this type of respirator does not filter or clean the air and that only NIOSH-approved airlines can be used with airline supplied-air respirators.

Airline supplied-air respirator styles include:

- Half-face elastomeric facepieces
- Full-face elastomeric facepieces
- Hoods or helmets that cover the head and neck
- Loose-fitting facepieces with rubber or fabric side shields

(Canadian Centre for Occupational Health and Safety, 2024)

Below are two types of airline supplied-air respirators that you may encounter on a farm. Some points to remember about both of these types include that they:

- Are positive pressure respirators
- Do not provide protection if the air supply fails
- Are not to be used in IDLH conditions
- Restrict movement due to the airline hose
- Can be permeable to some substances (the airline hose)

Pressure-Demand Airline Supplied-Air Breathing Apparatus	Continuous-Flow Airline Supplied-Air Breathing Apparatus
• This type of respirator maintains a positive pressure in the facepiece using regulators and exhalation valves. • The positive pressure combined with the flow of clean air to the facepiece reduces the chances of contaminated air leaking inside. • This is used where the air supply is limited, such as from a compressed air tank.	• This type of respirator provides a steady supply of air to the respirator user. • The facepiece, hood, helmet or suit remains under positive pressure. • This can be used where the air supply is not limited, such as when the source of air is a compressor or low-pressure pump.

IMPORTANT

"Only positive-pressure equipped (airline supplied-air respirators) with an escape air-supply bottle may be used in immediately dangerous to life or health (IDLH) situations (Alberta Government, 2020, p.4)."

Self-Contained Breathing Apparatus (SCBA)

Self-contained breathing apparatus (SCBA) is a type of respirator that has a portable supply of breathing air which is separate from the surrounding atmosphere. The air is supplied by one or two high-pressure tanks worn by the respirator user. While there are open-circuit and closed-circuit types of SCBA, the type that will most commonly be used in agricultural operations is the open-circuit type. In an open-circuit SCBA, the air that is breathed in from the compressed air tank is exhaled out into the work environment. SCBA, as with all forms of reusable respirators, must be handled, stored, maintained, and cleaned as directed by the manufacturer.

Due to the added complexity of SCBA in comparison to some other types of respiratory protective equipment and the dangerous conditions it may be used in, receiving training directly from the manufacturer or someone authorized by the manufacturer is highly recommended. There may be some differences between manufacturers, so it is important to ensure that the training respirator users receive is based on that specific manufacturer's instructions.

SCBA Advantages	SCBA Disadvantages
• May be used in IDLH environments • The respirator user does not have to worry about an air-supplying hose line getting caught on something • SCBA with quick-connecting cylinders are easy to change out	• The air supply is limited • Requires more training • Units worn by the respirator user are bulky and heavy • The compressed air used must meet certain standards (CSA Standard Z180.1-13: *Compressed Breathing Air and Systems*) • Not suitable for routine use or for use over long, continuous periods due to limited service life (National Institute for Occupational Safety and Health, 2019)

IMPORTANT

The Alberta Government states that only positive pressure respirators may be used in IDLH situations (Alberta Government, 2009, p.4). When respiratory protective equipment is used in IDLH areas:

- The respirator user will require hazard specific training (e.g., Confined Space Training, training related to working in areas that do or may have H_2S present).
- Special care may need to be taken to *decontaminate* the respiratory protective equipment following use.

NOTE

Closed-circuit SCBA (also called rebreathers) have limited applications, are unlikely to be found on farms, and are not covered in this manual.

RESOURCE

For more information and considerations relating to SCBA refer to the standards listed below. Visit **community.csagroup.org** and create an account to view CAN/CSA Standards at no cost.

- Inspection and hydrostatic testing requirements of SCBA cylinders can be found in Clauses 11.3.3 and 11.6.2 of the CAN/CSA Standard Z94.4-18 *Selection, use and care of respirators.*
- The use of SCBA in cold temperatures, refer to Annex D Use of SCBA in low-temperature environments in the CAN/CSA Standard Z94.4-18 *Selection, use and care of respirators.*
- The minimum requirements for the purity of compressed breathing air, refer to the CAN/CSA Standard Z94.4-18 *Selection, use and care of respirators.*
- The service time and use of SCBA in IDLH atmospheres, refer to Clauses 10.2.2.5 and 10.6.2 of the CAN/CSA Standard Z94.4-18 *Selection, use and care of Respirators.*

Multi-Functional Respirators

A multi-functional respirator is a type of respirator that can operate as either an air-purifying or an atmosphere-supplying respirator. The term multi-functional respirator is used in CAN/CSA Standard Z94.4-18 S*election, use and care of respirators*, however, the Centers for Disease Control and Prevention (CDC) and the National Institute for Occupational Health and Safety (NIOSH) commonly refer to these as combination respirators.

It is common for this type of respirator to have a small self-contained air supply (or escape cylinder). This is because the escape cylinder is exactly that; it provides enough air to escape from an IDLH atmosphere.

RESOURCES

Refer to **Appendix B: Respirator Selection Table** in this manual to help you better understand the different types of respirators and their applications in Alberta workplaces.

More information regarding respirator types can be found in Annex G *Respirator classification, characteristics, and limitations* of CAN/CSA Standard Z94.4-18 *Selection, use and care of respirators.*

DID YOU KNOW?

An escape-only respirator must *never* be used to enter a contaminated atmosphere.

Airline supplied-air respirator: A type of respirator that is connected to a separate source of air and provides clean air through a hose called an airline.

Combination respirators: Refer to the term *Multi-functional respirators.*

Compressed breathing air: Normal air that is processed by a compressed breathing air system and meets the purity requirements CSA Z180.1 *Compressed breathing air and systems.*

Decontaminate: To remove or neutralize a harmful, irritating or nuisance material that has built up on something or someone.

Escape cylinder: 1. A self-contained breathing air supply that is used for emergency escape from an IDLH atmosphere. 2. A small secondary air cylinder that is used when the supplied-air fails or if the respirator user must disconnect from the supplied-air for any reason.

Escape-only respirator: A respirator designed to be used to escape from a hazardous atmosphere only.

Multi-functional respirator: Sometimes called a combination respirator, this is a type of respirator that can operate as either an air-purifying or an atmosphere-supplying respirator.

Permeable: A material that allows liquids or gases to enter or pass through it.

Rebreather: Refer to the term *Self-contained breathing apparatus (SCBA) – Closed Circuit.*

Self-contained breathing apparatus (SCBA): A respirator that has a portable supply of breathing air which is separate from the surrounding atmosphere (work environment).

Self-contained breathing apparatus (SCBA)—closed circuit: A respirator that has a portable supply of compressed breathing air which is separate from the air in the work environment; the exhaled air is 'rebreathed' by the respirator user after it has recirculated in the system (where the carbon dioxide is removed, and the oxygen concentration restored to acceptable levels).

Self-contained breathing apparatus (SCBA)—open circuit: A respirator that has a portable supply of compressed breathing air which is separate from the air in the work environment; the exhaled air is not recirculated in the system, but rather passes out of the respirator into the work environment.

MODULE

4

Filters, Cartridges, & Canisters

In this module, readers will:

1. Become familiar with the **differences between particulate** filters, cartridges, and canisters.
2. Gain a general understanding of the different types of filters, **cartridges, and canisters.**
3. Learn about warning properties and end-of-service life indicators (ESLI).
4. Learn about when to change a filter, **cartridge, or canister.**

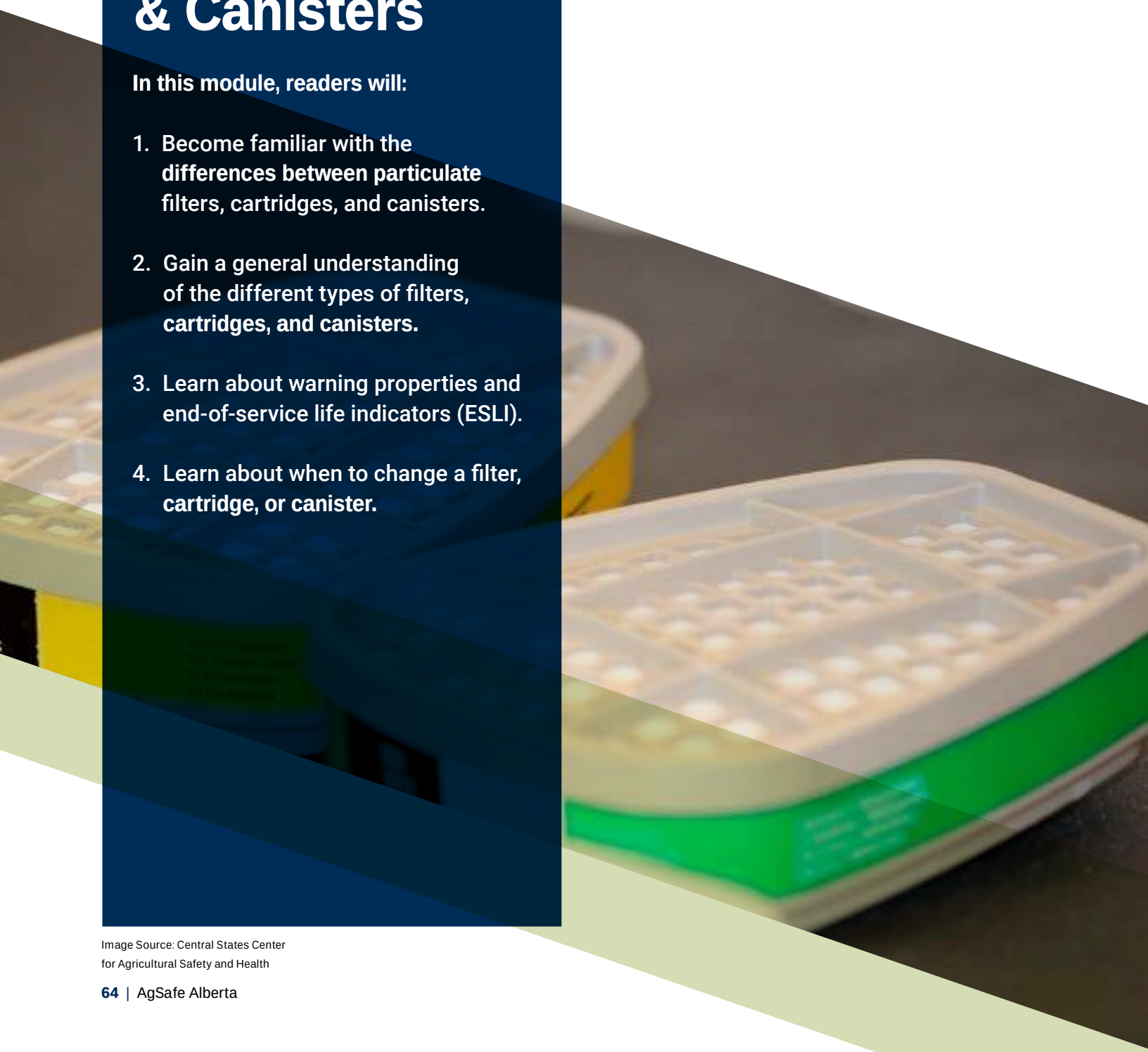


Image Source: Central States Center for Agricultural Safety and Health

INTRODUCTION

Filters, cartridges and canisters are used with air-purifying respirators; they are designed to remove specific contaminants from the air that passes through them. As you will learn in this module, it is important to select the correct type of filter for the contaminant(s) present, and as they have a limited-service life, there are factors that must be taken into account.

Before moving further, let's take a moment to ensure that we are clear on what filters, cartridges and cannisters are.

Filters

A filter or air-purifying element is a "component used in respirators to remove solid or liquid aerosols from the inspired air (Occupational Safety and Health Administration, 2009, p.8). "

Particulate Filters

A particulate filter provides protection from dusts, fumes, and/or mists. They use a fibrous material to trap particles in the air that is pulled through them. Particulate filters are classified based on the type of particulate they will be filtering as well as on their level of oil resistance and filter efficiency. Due to the fact these filters capture particles, they can become blocked by the particles they are filtering out which will make it very difficult for air to pass through them.

(National Institute for Occupational Safety and Health, 1987, p.13 & 22)

Cartridges & Canisters

The terms cartridge and canister are often used interchangeably. A cartridge or canister is a "container with a filter, sorbent, or catalyst, or combination of these items, which removes specific contaminants from the air passed through the container (Occupational Safety and Health Administration, 2009, p.8)." Respirators with cartridges will be more commonly found on farms, where what we tend to think of as gas masks with canisters will be less common.

The primary difference between a cartridge and a canister is the volume of sorbent material it contains; canisters hold a larger volume of sorbent material and as a result can be used in areas with higher concentrations of gases and vapours. Due to the fact cartridges contain a lower volume of sorbent material, they can only be used where the concentration of gases and vapours is low.

(National Institute for Occupational Safety and Health, 1987, p.30)

IMPORTANT

Cartridges can become wet or saturated, which will prevent them from working properly and can result in breakthrough exposure to the gas and/or vapour.

Breakthrough exposure: Also called breakthrough, occurs when a chemical cartridge becomes wet or saturated and the gases or vapours leak through the cartridge and can be breathed in by the respirator user.

Cartridge: 1. Sometimes used interchangeably with the term canister, this type of respirator filter removes gases, volatile organic compounds (VOCs) and other vapours from the air being inhaled by a respirator user. 2. A "container with a filter, sorbent, or catalyst, or combination of these items, which removes specific contaminants from the air passed through the container (Occupational Safety and Health Administration, 2009, p.8)."

Exposure: To be exposed to, and not protected from, something.

Filter: A "component used in respirators to remove solid or liquid aerosols from the inspired air (Occupational Safety and Health Administration, 2009, p.8). "

Inspired: Air that is breathed in.

Particulate filter: A filter designed to remove solid particles from the air being inhaled by a respirator user

Service life: The acceptable period of use in service or the expected lifetime of the respiratory protective equipment where it will provide adequate protection to the respirator user.

PARTICULATE FILTERS

Particulate Filters for Powered & Non-Powered Air-Purifying Respirators

The filter in your respirator plays an important role in keeping you safe while you work. Ensuring that you are using the correct type of filter for the contaminant(s) in the work environment is essential. There are differences between the filters used in powered air-purifying respirators and non-powered air-purifying respirators.

Let's take a look at what these differences are:

Powered Air-Purifying Respirator Filters	Non-Powered Air-Purifying Respirator Filters
Only use high-efficiency (HE) particulate air filters, also called HEPA filters. (National Institute for Occupational Safety and Health, 2018, p.3)	Nine classes of NIOSH approved particulate filters based on three levels of filter efficiency as outlined on the following pages.

Main Categories of Particulate Filters

There are different classes of particulate filters, depending on the type of contaminant in particulate form. Particulate filters are also classified based on levels of oil resistance and filter efficiency. It is important to remember that oil can break down certain types of filters, so you must ensure that you know what materials are or may be present in the work area and that you have selected the right type of filter.

Filter Type				
Class	**Explanation**	**95% Efficiency**	**99% Efficiency**	**99.7% Efficiency**
N	N stands for ***Not resistant to oil***; used where there is no oil particulate.	N95	N99	N100
R	R stands for ***Resistant to oil***; used where there is no oil particulate, or up to one shift where there is oil particulate present.	R95	R99	R100
P	P stand for ***oil Proof***; used in atmospheres including those with oil particulates, for more than one shift. When used in atmospheres with oil particulates, you should contact the manufacturer to find out the service life.	P95	P99	P100

(National Institute for Occupational Safety and Health, 1996)

IMPORTANT

Oil can break down certain types of filters which means it is important to know the materials you are working with at all times and always select the right filter for your respirator. An oil may be a mineral oil, vegetable oil, synthetic substance, animal fat, or vegetable fat.

COLOR CODING FOR CHEMICAL CARTRIDGES/CANISTERS

The chart below is intended to help support you in selecting the correct type of cartridge or canister for your particular application. However, the farm will still need to consult its hazard assessments, all applicable product labels and/or safety data sheets, manufacturer's information, etc., to ensure that the cartridge or canister chosen will provide adequate protection.

IMPORTANT

Remember that the contaminants listed below would be found in low concentrations only, and that high concentrations would require a high level of protection that could only be provided by a supplied-air respirator, such as an SCBA.

CONTAMINANT	COLOR CODING DESCRIPTION
Acid gases	WHITE
Hydrocyanic acid gas	WHITE with ½ inch GREEN stripe completely around the canister near the bottom
Chlorine gas	WHITE with ½ inch YELLOW stripe completely around the canister near the bottom
Organic vapors	BLACK
Ammonia gas	GREEN
Acid gases and ammonia gas	GREEN with ½ inch WHITE stripe completely around the canister near the bottom
Acid gases & organic vapors	YELLOW
Hydrocyanic acid gas and chloropicrin vapor	YELLOW with ½ inch BLUE stripe completely around the canister near the bottom
Acid gases, organic vapors, and ammonia gases	BROWN
Pesticides	Organic vapor canister plus a particulate filter
Multi-Contaminant and CBRN agent	OLIVE
Any particulates - P100	PURPLE (MAGENTA)
Any particulates - P95, P99, R95, R99, R100	ORANGE
Any particulates free of oil - N95, N99, or N100	TEAL

(Occupational Safety and Health Administration, n.d.)

Combination Cartridges

Some cartridges will consist of both a chemical cartridge and a particulate filter which will protect the respirator user from different types of contaminants; these are commonly referred to as combination cartridges.

An example of a combination cartridge would be an organic vapour and acid gas (OV/AG) respirator cartridge with a P100 filter. The manufacturer will list the specific types of chemicals that it can offer protection from in the packaging and on the cartridge itself.

OV ➔ Organic vapours

AG ➔ Acid gases

P ➔ Oil proof

100 ➔ Filters at least 99.97% of airborne particles

RESOURCE

To see what these colors and cartridge combinations look like, you can refer to the following guides:

- Honeywell North Cartridge & Filter Reference Chart
- 3M Cartridge and Filter Guide

High efficiency (HE) filter: Refer to the definition of High efficiency particulate air (HEPA) filter.

High efficiency particulate air (HEPA) filter: 1. A type of mechanical air filter that can remove at least 99.97% of airborne particles with a size of 0.3 microns. 2. “A filter that is at least 99.97% efficient in removing monodisperse particles of 0.3 micrometers in diameter. The equivalent NIOSH 42 CFR 84 particulate filters are the N100, R100, and P100 filters (Occupational Safety and Health Administration, 2009).

Monodisperse: Particles that are the same size that have been distributed or spread over a wide area.

Oil: A liquid made up of organic molecules.

Oil proof: Does not allow oil to pass through it or is not affected by oil.

One shift: A term that means eight hours of continuous or intermittent use (Canadian Centre for Occupational Health and Safety, 2024).

WARNING PROPERTIES & END-OF-SERVICE LIFE INDICATORS (ESLI)

Some contaminants have what are called warning properties. These warning properties rely on our sense of smell, taste and our ability to feel irritation in our respiratory tract (the nose, throat, trachea, bronchi and lungs) in order to detect these contaminants. Warning properties can be very helpful as they let us know when a cartridge is saturated and is no longer working before it is scheduled to be changed out, however, we need to recognize that if you can sense a contaminant, you are being exposed to it and need to take the appropriate steps quickly.

Different contaminants will have different warning properties; some may have poor warning properties and some individuals may not be able to detect the warning properties of some contaminants. Gas and vapour cartridges should only be used if the contaminants they are protecting the respirator user from have adequate warning properties and the respirator user is able to detect them. Cartridges should not be used for contaminants with poor warning properties unless the cartridge being used has an end-of-service-life indicator.

End-of-service-life indicators (ESLI) are devices designed for use with contaminants that have poor warning signs; these devices change color to show when a cartridge has been used up, is no longer effective, and needs to be changed. An example of this would be an indicator bar on a cartridge. Air-purifying respirators may only be used for contaminants with poor warning properties (e.g., cannot be smelled) if they are equipped with an end-of-service-life indicator. While there may be exceptions in certain circumstances and only when critical conditions are met, it is best practice to avoid this.

(Alberta Government, 2020, p.8)

KEY POINTS TO REMEMBER

- When a contaminant has poor warning properties and a cartridge with an end-of-service-life indicator is not possible, an air-supplying respirator must be used.
- An important part of selecting the right type of respirator includes finding out what the warning properties of the contaminant(s) are.

DID YOU KNOW?

Not everyone may be able to sense a contaminant. Most people will recognize ammonia at levels of 20 to 30 ppm. Individuals with frequent exposure to recognizable ammonia gas levels lose their sensitivity to it and may no longer detect high levels of ammonia (50 to 100 ppm)(Fabian, E., 2023). These individuals will not be able to sense breakthrough exposure and special measures, such as using a cartridge equipped with an ESLI, will need to be taken to ensure they are protected.

End-of-service-life indicator (ESLI): A device that is designed for use with contaminants with poor warning signs. These devices change color to show when a cartridge has been used up, is no longer effective, and needs to be changed.

Warning properties: These are properties that tell the respirator user when a cartridge is no longer working. Different contaminants have different warning properties, such as an odour, a taste or a feeling of irritation in the respiratory tract (nose, throat, larynx, trachea, bronchi and lungs).

WHEN TO CHANGE A FILTER, CARTRIDGE, OR CANISTER

The use of warning properties (waiting for a breakthrough exposure to occur) is not an acceptable way to find out that it is time to change out a cartridge or cannister.

Highlights of Clause 10.2 *Change-out procedures, schedules, and service time* in CAN/CSA Standard Z94.4-18 S*election, use and care of respirators* state the following:

- A qualified person is responsible for creating a change-out schedule that will ensure air-purifying filters or cartridges are replaced before their useful service life ends.
- If a respirator user detects an odour or experiences respiratory irritation before the end of the change-out schedule, they must advise the respirator program administrator; the administrator will then need to re-evaluate the change-out schedule, workplace contaminant concentrations and other applicable conditions of use.
- When deciding on a change-out schedule, the following items should be considered:
    - End-of-service-life indicators
    - Manufacturer's product information & guidance
    - Maximum use times
    - Breathing resistance
    - Other information as appropriate

(Canadian Standards Council, 2018, pg.54-55)

Factors Affecting Useful Service Life

There are many factors that can affect the useful service life of a filter, cartridge, or canister; these include:

- The contaminants properties, physical state, and concentration.
- Characteristics of the work environment, the temperature, humidity, and atmospheric pressure.
- The surface area and volume of the filter, cartridge, or canister.
- How the filter, cartridge, or canister removes the contaminant, such as by filtration, electrostatic charge, absorption or adsorption.
- How effective the filter, cartridge, or canister is at removing the contaminants.
- The breathing rate and volume of the respirator user.
- How often the filter, cartridge, or canister is used, for example, constantly or only once in a while.

NOTE

Absorption & Adsorption

The process of absorption is familiar and can be thought of as a sponge that sucks up a product. In contrast, adsorption is a process where molecules stick to surface of something, such as when organic molecules stick the surface of activated carbon.

RESOURCE

When determining an appropriate change out schedule, a qualified person should refer to the information provided by the manufacturer. The Occupational Safety and Health Administration (OSHA) model found here will also be helpful: https://www.osha.gov/etools/respiratory-protection/change-schedules

General Guidelines for Replacing Cartridges and Filters

The information below is for general guidance only. Factors and conditions on each farm will be different; for more detailed information, refer to CAN/CSA Standard Z94.4-18 *Selection, use and care of respirators.* Also remember that the manufacturer will be able to provide more detailed information regarding the service life and limitations of the particular filter, cartridge or canister being used.

Gas/vapour cartridges or canisters will be replaced:

- When the end-of-service-life indicator shows it is time.
- As required by the change-out procedure/schedule.
- If the respirator user can sense one of the warning properties before the change-out time indicated by change-out procedure/schedule.
    - The program administrator/person in charge of respiratory protective equipment must be advised if this occurs!

Particulate filters will be replaced:

- When they are damaged or dirty/unsanitary.
- As required by the change-out procedure/schedule.
- When breathing becomes difficult.
- When air flow on a powered air-purifying respirator does not meet the manufacturer's specifications.
- If 'R' filters have been used in an atmosphere where oil is present, after 8 hours of use or after the respirator has been exposed to 200 mg of contaminant.*

IMPORTANT

Never attempt to wash or re-use a filter or cartridge!

*Some exceptions may apply, refer to Clause 10.2.2.4.3 of the CAN/CSA Standard Z94.4-18 *Selection, use and care of respirators* for more information.

MODULE

5

Respirator Selection

In this module, readers will:

1. Gain a general understanding of how respirators are selected for the task and work environment.
2. Review purchasing considerations and be shown a comparison of two types of respirators.
3. Learn more about a Respiratory Protective Equipment Code of Practice or Respiratory Protection Program and why the farm should have one.

Image Source: Central States Center for Agricultural Safety and Health

INTRODUCTION

Many factors need to be considered when selecting the appropriate type of respiratory protective equipment, this includes but is certainly not limited to whether or not the equipment is going to be used for IDLH and/or emergency conditions.

The farm will need to perform thorough hazard assessments to identify the hazards and determine the degree of danger that is or may become present. It will then need to address these hazards using the hierarchy of controls that you learned about in Module 2: Respiratory Hazards & How to Control Them.

If the hazards cannot be reduced to a reasonable level through the other hazard controls that get put in place, or if other hazard controls measures are not found to be reasonably practicable, the hazard assessments will be used to help select the right type of respiratory protective equipment for the conditions. The farm will also need to stay informed of any changes in conditions or work that may affect the degree of protection provided by the respiratory protective equipment.

RESPIRATOR SELECTION CONSIDERATIONS

The person selecting respiratory protective equipment for the farm must qualified and competent to do so, as they will need to consider the following factors:

- The usual and expected characteristics of the contaminant.
- The concentration or likely concentration of airborne contaminants.
- Duration or likely duration of the respirator user's exposure.
- Toxicity of the contaminants.
- The oxygen concentration in the work area.
- Warning properties of the contaminants.
- The need for emergency escape.

(Alberta Government, 2020, p.1)

Concentration: The amount of a substance in a defined space.

Duration: The time during which something occurs.

Toxicity: The property of a substance being harmful to a living thing and the level of harm it can cause.

IMPORTANT

Always remember that:

- Conditions at a worksite can change in a way that might affect the level of protection provided by the respirator.
- Some form of ongoing hazard assessment is essential!

Questions That Will Help You in Selecting the Proper Type of Respirator

Taking the time to carefully and thoughtfully select the appropriate type of respirator is critical to ensuring that the person wearing it is protected from the respiratory hazards in their work environment. Answering the following questions will help guide you in selecting the appropriate respirator.

Key Questions	Follow Up Questions & Considerations

Is the area oxygen deficient or could it become oxygen deficient?	• Could it potentially be oxygen deficient? What conditions are present or could develop? You need to find out!
	• If the oxygen level is 19.5% or lower, it is an oxygen deficient environment.
	• The cause of the deficiency will need to be identified and appropriate steps taken:
	  ▸ Ongoing monitoring, or
	  ▸ Assume the atmosphere is IDLH.
	• If an oxygen deficient atmosphere exists and cannot be corrected using other types of hazard controls, such as ventilation fans (a form of engineered hazard control), a supplied-air respirator must be used.

Is there an IDLH atmosphere? Could an IDLH atmosphere or emergency situation develop?	• For information about occupational exposure limits, refer to Schedule 1 of the **Alberta Occupational Health and Safety Code.** • For the IDLH values of specific substances, refer to the **NIOSH Pocket Guide to Chemical Hazards 2005-149.** • In an emergency where the appropriate people or resources could not be obtained to identify the presence of contaminants or an oxygen deficient environment, an air-supplying respirator must be used.
Are there or could there be biological hazards in the air?	• Are there any biological contaminants, such as dried urine or feces that could be stirred up and enter the air? • Are there or could there be any zoonotic diseases present?

Key Questions	Follow Up Questions & Considerations
Are there or could there be airborne contaminants?	• Are there any dusts, fibres, mists, fumes, gases, or vapours present? • Some contaminants may be present in more than one form, for example, welding processes produce both metal fumes and gases. • Is there any potential for oil to become airborne (e.g., any milling or drilling using cutting fluid)? • What type of harm could the contaminants cause?
What are the hazards or toxic properties of the contaminant(s) and their harmful effects?	• It is important to know the effects of exposure to the contaminant and to consider them when selecting a respirator. • The respirator must be approved to protect the respirator user from the contaminant(s) identified. • The filter, canister, or cartridge used must be approved for the contaminant(s) identified. • If a contaminant requires both respiratory and eye protection, it may be appropriate to use a full-facepiece respirator.
How long will the respirator need to be worn?	• Some types of respirators can be worn for longer periods of time than others. • A very important consideration is comfort, especially when a respirator needs to be worn for extended periods of time.
How will the respirator user know when to replace the filter(s), cartridge(s), or canisters?	• What will be the change-out schedule? • Does the respirator cartridge have an end-of-service-life indicator? • How will the respirator user be able to recognize the warning properties?
How will the respirator user know if the respirator has a poor fit, is damaged, developed a leak, or a breakthrough has occurred?	• How will the respirator user know the concentration at which most people will smell the substance or at which their nose or throat will become irritated? • It is important that when a contaminant can be detected by smell or irritation, the respirator fits poorly, has developed a leak, or needs new cartridges as a breakthrough has occurred and the respirator user must advise the respirator program administrator that this has happened.
Are there, or could there be, emergency situations where someone would need to escape?	• What would the hazards be? • What types of respiratory protection would be appropriate?

(Adapted from Occupational Safety and Health Administration, 2011, p.16-23, p.62)

Questions That Will Help You in Selecting the Right Make & Model of Respirator

Now we will look at how to select the proper model of respirator. There are many makes and models of respirators available, and sometimes it can feel just as confusing as choosing the right type of respirator. Answering the questions in the table that follows will help you with this part as well. Talking to one of the manufacturers' representatives can also assist you greatly.

Key Questions	Follow Up Questions & Considerations
Does the model meet regulatory approval?	• Respirators must be approved by the National Institute for Occupational Safety (NIOSH), or another comparable organization approved by Alberta Labour.
Is the respirator being used as it is intended and in accordance with manufacturers specifications? What about the other equipment being used with the respirator?	• Breathing air used in air-supplying respirators can be supplied from a high-pressure compressor, a low-pressure ambient air pump, or by compressed air cylinders. • Air supplied by a tank or compressor, it must meet standards for purity and moisture content as outlined in the CSA Standard Z180.1-13: *Compressed breathing air and systems.* • Only NIOSH-approved airlines can be used with airline air-supplying respirators. • Always refer to the manufacturer's directions and ensure all respirator users are trained and competent.
Is the facial fit satisfactory?	• Facepieces come in different sizes and may be made of different materials depending on the model. • Different models of respirator, in the same size and made by the same manufacturer, may still fit a respirator user's face differently.
How comfortable will the respirator user be?	• Every reasonable effort should be made to select a respirator that is as comfortable as possible. • The more comfortable a respirator is, the more likely it is to be used and worn properly. • If the respirator selected causes the respirator user an unreasonable amount of discomfort it will be distracting and interfere with their ability to focus, which will create other issues. • Is the weight of the respirator reasonable for the respirator user and the task they are performing?

Key Questions	Follow Up Questions & Considerations
What other personal protective equipment (PPE) will be worn?	• Will the respirator user be wearing a hardhat, welding helmet, protective eyewear, etc.? • Will the other PPE that must be worn interfere with the respirator or vice versa?
Will communication, vision, or movement be affected by the respirator?	• If any of these are drastically impacted and cannot be addressed in some way, another model may be required.

(Adapted from Occupational Safety and Health Administration, 2011, 16-21)

NOTE

When for any reason an alternate type or model of respirator is selected, it must have a protection factor equal to or greater than the protection factor of the respirator type originally chosen.

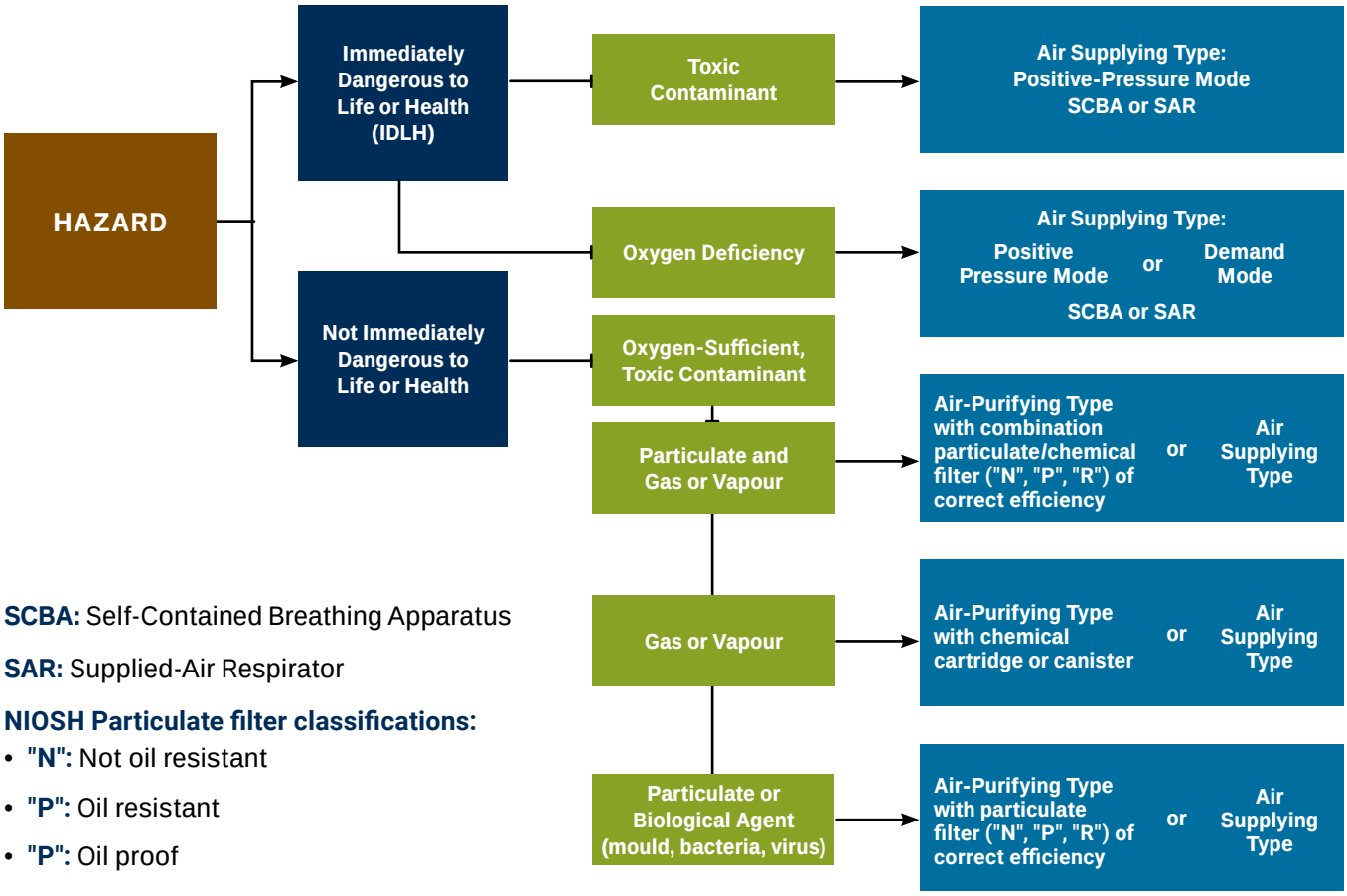
KEY POINTS TO REMEMBER

Other things you will need to consider, and check on regularly once these respirators are in use, will include:

- Is the person wearing the respirator confident that it is protecting them?
- Is the person wearing it confident in their own ability to use the respirator properly?

Respiratory Protective Equipment Decision Tree

Another way to think about choosing the appropriate type of respiratory protective equipment is to use a flow chart, like the one that follows:



SCBA: Self-Contained Breathing Apparatus

SAR: Supplied-Air Respirator

NIOSH Particulate filter classifications:

- **"N":** Not oil resistant
- **"P":** Oil resistant
- **"P":** Oil proof

(Alberta Government, 2020, p.10)

Purchasing Considerations

While some types of respirators will be more costly to purchase initially, they may provide longer-term cost savings.

Many elastomeric respirators have replacement parts that can be purchased (e.g., valves, harnesses, and gaskets) and when this type of respirator is maintained properly, it will not only be more comfortable than other types but last a very long time as well.

	
N95	Elastomeric Half-Facepiece Respirator
Lower cost	Higher cost
Singe use	Reusable
Straps are not adjustable and the facepiece can be rather stiff	Straps can be adjusted to the user and elastomeric or silicone facepieces can conform better to the user's face
Protects against particulates	Can be fitted with filters, cartridges, or combination cartridges making them quite versatile in the protection offered
Requires proper handling, but no maintenance required	Requires proper handling, storage, maintenance & cleaning
Requires less training	Requires a bit more training than an N95

Respiratory Protective Equipment Code of Practice or Respiratory Protection Program

As you learned earlier, a Respiratory Protective Equipment Code of Practice (which is referenced in the Alberta Occupational Health and Safety Code) and a Respiratory Protection Program (which is referenced in CAN/CSA Standard Z94.4-18 *Selection, use and care of respirators*) are both written guidelines containing similar information that have been set out by the Alberta Government and the CSA Group respectively for the purpose of helping employers become compliant with various standards and legislation, and ultimately help employers protect the health and safety of their workers.

The Alberta Occupational Health and Safety (OHS) Code requires that a Code of Practice describing the selection, maintenance and use of respiratory protective equipment be developed whenever respirators are used at a worksite. While not all of the Alberta Occupational Health and Safety Code applies to farms and ranches at the time of publication, the OHS Act does.

The OHS Act states that as far as it is reasonably practicable, an employer shall ensure the health and safety of workers and make certain that workers are adequately trained in all matters necessary to protect their health and safety. Developing a Code of Practice will help you ensure that these obligations are met as well as help you show due diligence; in simple terms, having a Code of Practice is a best practice.

Do not let the term Respiratory Protective Equipment Code of Practice or Respiratory Protection Program frighten you. Remember that they are both simply written guidelines that help to ensure that ethical, health and safety standards are met. This written guideline should address such key elements relating to respiratory protection on the farm, including the selection, maintenance, and use of respiratory protective equipment.

DID YOU KNOW?

A written respiratory protection program is an important reference point, as it clearly states things like:

- What type of respiratory protection is to be used on the farm and when.
- How the respiratory protection was selected, what it can do and what it can't do.
- What training is needed to use the respirator.
- How the respirator will be maintained and cared for.

You can learn more about what to include in your farm's respiratory protection program, refer to **Appendix E: Respiratory Protection Program Overview.**

RESOURCE

A brief overview of the elements to include in a Respiratory Protective Equipment Code of Practice or Respiratory Protection Program can be found further in **Appendix E: Respiratory Protective Equipment Code of Practice Overview.**

Best practice: An agreed-upon method for conducting a specified task that is usually established by industries, trades or groups of peers.

Code of practice: A written guideline used to help ensure that ethical and health standards are met.

Due diligence: The level of judgment, care, caution, purpose, and activity that a person would reasonably be expected to do under specific circumstances; it can only be shown by actions taken before an event occurs.

Respiratory protection program: Farm specific written procedures and policies that together enhance employee health, promote the effective use of respiratory protective equipment, and make it easier to meet legislative, ethical and health standards.

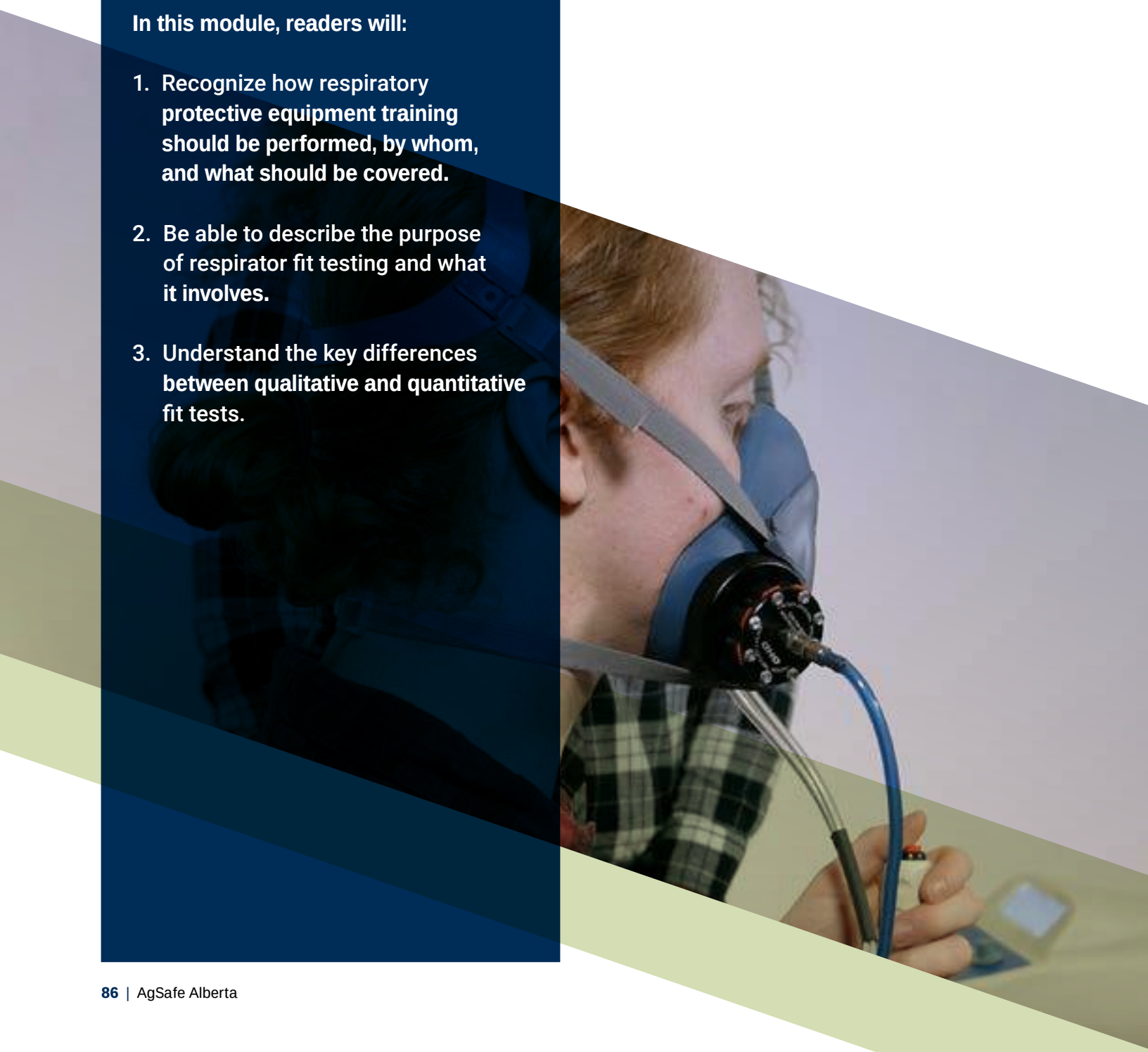
MODULE

6

User Training and Fit Testing

In this module, readers will:

1. Recognize how respiratory protective equipment training should be performed, by whom, and what should be covered.
2. Be able to describe the purpose of respirator fit testing and what it involves.
3. Understand the key differences between qualitative and quantitative fit tests.



INTRODUCTION

Anyone performing work must be adequately trained and deemed competent before they perform the task. Where respiratory protective equipment is or may be needed, training in the use, care, maintenance, and limitations of respirators is essential. Any training provided must be performed by a qualified person and should follow the three basic parts of training delivery outlined below.

Three Basic Parts of Training Delivery

Step	Explanation	Tips
1. Communicate the information.	• The respirator user is given essential information. • This can be done using many methods, as listed in the Tips section.	• Consider using more than one method, such as: videos and presentations; training sessions; pictures, drawings or diagrams; reviewing the farm's hazard assessments, safe job procedures and operator's manuals. • It is important to remember that we all learn differently and will favour some training methods over others. • Be mindful not to overload someone who is learning with too much information at one time.
2. Show the learner how it is done.	• The respirator user is shown how to use or apply the information that they have received. • While showing someone how to do a task, it is good practice to engage them in it as well.	• Tell the person being trained why something is done a certain way and ask them what they think you should do next. • Remember to encourage the person learning to ask questions, however, this only works if you have created an environment where someone feels safe to ask a question.
3. When the learner is ready, watch them perform the task.	• The respirator user practices the new skill they are learning and continues to do so until they can show they are competent. • Learning truly happens when the learner has an opportunity to apply their knowledge. You will want to be encouraging and not rush the learner. • A Fit Test not only tells you if a respirator fits properly, but it is also an indicator of whether or not the person has reached a level of competency with regards to wearing a respirator.	• Allow the learner to troubleshoot and solve problems themselves. • Remain patient, as it is better for someone to learn from a mistake made in a controlled or simulated situation than it is elsewhere. • Ensure that you have created an environment where someone feels safe asking a question and making a mistake in the controlled setting.

RESPIRATOR USER TRAINING

Image Source: Central States Center for Agricultural Safety and Health

The Alberta OHS Act requires that employers adequately train workers in all matters necessary to perform their work in a healthy and safe manner; this includes the use, care, maintenance and limitations of the respiratory protective equipment that they are required to wear.

Legislation also states that training should be provided by a qualified person. Becoming familiar with Alberta OHS legislation and CAN/CSA Standard Z94.4-18 *Selection, use and care of respirators* is a great starting point if you are tasked with creating a respiratory protection program on your farm. Examples of where external training may be obtained are listed in the Resource Box below.

RESOURCE

- Health and safety associations, such as AgSafe Alberta.
- Post-secondary educational institutions; many offer health and safety certificates or diplomas and some offer Personal Protective Equipment courses that can be taken individually.
- Manufacturers, such as **3M Canada** or **Honeywell (North)**. Manufacturers typically develop materials that address the inspection, use, care, maintenance, and storage of their products. These materials may be obtained from their website, and many even provide videos on YouTube.
- Suppliers & distributors.
- Local safety training providers.

Who Needs to Be Trained

Training should be provided to the following workplace parties:

- The respiratory protection program administrator (or equivalent)
- Individuals supervising workers who wear respirators
- Anyone who is or may be required to wear a respirator
- Anyone else who is involved in the respiratory protection program

Not everyone requires the same level of training, but everyone must be trained adequately so that they can perform their duties competently.

Topics That Should Be Included in Training

The hazards that make the respirator necessary.

- Include what the respiratory hazards are, how to identify them, and their potential health effects.
- Respiratory protective equipment is your last resort and is used in combination with other hazard control measures, so you will want to include the other hazard control measures that are in place.
- Any equipment that is used to detect the hazards, such as a gas monitor.

Why that type of respiratory protective equipment was chosen, what it can do, and what it cannot do.

- Cover what the respirator is capable of doing and what level of protection it offers.
- Explain how the respirator works, and what can happen if the respirator does not fit properly, is not used, and is not handled or stored properly.
- Employees must understand that proper fit, usage, storage, and maintenance of respirators is critical to ensure that they can perform their protective function.
- Include the limitations of the respirator.
    - Clearly state what the respirator cannot do and why it cannot do it; for example, a filtering facepiece respirator cannot protect the user from an oxygen deficient environment because it can only remove certain contaminants from the air and it cannot add oxygen to the air that the respirator user is breathing.
    - Things that may limit or prevent the respirator from being used effectively; these may include medical conditions.
- Remember that use of respiratory protective equipment in an IDLH environment or an environment that may become IDLH will require additional training, for example, hydrogen sulfide (H_2S) training or confined space training.

How to use the respirator properly.

- Cover how to inspect, put on and take the respirator off, as well as how to perform user seal checks.
- Ensure the user understands why they must not touch the filters, cartridges or filtering facepiece or a respirator that is in use or has been used.
- Include how to handle, store, clean, store, and maintain the respirator.
- Respirator users will need to know how to remove and replace filters, cartridges and/or canisters.
- What fit testing is, why it is done and when it needs to be performed and/or repeated.

How to properly select filters, cartridges, or canisters.

- Clearly communicate what filter, cartridge, or canister is for which task.
- Include the filter, cartridge, or canister change schedule and estimated service life of each.

What to do if the respirator is damaged, leaks, or fails in any way.

- Cover what the procedure for dealing with damage, leaks, and failure is.
- Communicate how the respiratory protection program administrator will be informed of any issues, as something may need to be changed.

How to use the respirator in emergency situations.

- Address how to use the respirator in emergency situations, such as malfunctions, failures, or the release of an airborne contaminant.
- Include the procedure for dealing with a failure, emergency situation, or when there is a change in the work environment.
- If the respiratory protective equipment is going to be used in emergency situations and/or for rescue applications, additional training and considerations will need to be taken into account.

Refresher Training

Training needs to be updated on a regular basis, such as when there is a change in the work conditions, a different type of respiratory protective equipment is going to be used, or something else indicates it is needed. An example of what might indicate the need for refresher training would be a request from the respirator user for additional support, a near miss, or an incident involving respiratory protective equipment occurs.

Competent person: "In relation to a person, means adequately qualified, suitably trained and with sufficient experience to safely perform work without supervision or with only a minimal degree of supervision (Alberta Government, 2023, s.1(d))."

Inspection: The act of carefully and critically examining something to ensure it is free from weaknesses or limitations.

Training: An act or process where skill, knowledge and experience are provided to a worker with respect to a particular subject matter and which requires a practical demonstration by the worker to support that they have acquired the knowledge or skill they have been learning.

FIT TESTING

If the people on your farm need to wear respirators, they will also need to be fit tested. A fit test checks the make, model, and size of a respirator on an individual user to ensure that it will provide the expected level of protection. A fit test also performs other important functions, such as:

- It is a demonstration of competency, as it can show that the respirator user is able to inspect, put on, and take off a respirator properly, as well as successfully perform user seal checks.
- It can help verify that the respirator provides the user with a reasonable level of comfort.

Image Source: Central States Center for Agricultural Safety and Health

IMPORTANT

Not everyone is able to wear a respirator; for example, respirators are not designed to fit children's faces and individuals with certain conditions may not be able to wear them either. Before someone is fit with a respirator and fit tested, they will first need to be screened.

SCREEN THE RESPIRATOR USER → **FIT THE RESPIRATOR USER WITH A RESPIRATOR** → **PERFORM A FIT TEST**

Screening of Respirator Users

Respirators are not suitable for everyone. Individuals with any medical condition (physical or psychological) that may prevent them from using a respirator should check with their health care provider first. The health care provider will require the following information in order to provide appropriate advice:

- Information about the type of work to be done
- The types of contaminants present
- The work environment and conditions
- The type of respirator being used
- How often and for how long the respirator will be worn

Some medical conditions that may prevent a person from using a respirator include:

- Asthma
- Emphysema
- Chronic bronchitis
- Shortness of breath
- Lung disease
- Chest pain on exertion
- Heart problems
- Hypertension
- Cardiovascular disease
- Thyroid problems
- Diabetes
- Neuromuscular disease
- Fainting spells
- Dizziness/nausea
- Seizures
- Claustrophobia
- Pacemaker
- Panic attacks
- Reduced sense of smell
- Reduced sense of taste
- Back/neck problems
- Uncommon facial features
- Diagnosed skin conditions
- Temperature susceptibility
- Physical factors that would affect the ability to put on or adjust a respirator
- Use of certain medications that may affect lungs, heart, cause drowsiness or reduce alertness
- Past problems with respirator use

KEY POINTS TO REMEMBER

A reduced, or non-existent sense of smell may prevent someone from wearing a respirator as they may be unable to sense a breakthrough or when a contaminant is leaking into a facepiece.

Protection of Privacy

For privacy reasons, a health care provider can only advise an employer whether or not the employee can use a respirator. Any limitations identified by the health care professional must be explicitly written. Personal medical information cannot be disclosed to an employer without the employee giving their informed consent first and the employer should not request or collect information that is not necessary.

Records relating to a respirator user's ability to use a respirator, including any limitations of use, will need to be securely stored and only accessed by an authorized person when necessary; this is because they are confidential records. All health information needs to be treated as confidential and protected. Ensuring that the farm is collecting, using and protecting personal information appropriately is important. The Personal Information Protection Act (PIPA) is a valuable resource that will support you in doing this. Visit **http://www.alberta.ca/personal-information-protection-act.aspx** to learn more about PIPA and what your farm should be doing.

RESOURCE

Refer to **Appendix F: Screening Form Example** in this manual to see an example of what a respirator user screening form looks like.

Confidential records: Types of documentation (e.g., written, electronic, photograph, etc.) that contain private information, such as medical information, birthdates, home addresses, etc., that need to be stored in a way that is secure and can only be accessed by authorized individuals for work related reasons.

Demonstration of Competency: A written or demonstrated understanding of the required knowledge, skills, practices and procedures.

Screening: Evaluating something or someone to assess ability or suitability, such as screening someone to ensure that it is safe for them to wear a respirator.

Respirator Fitting Considerations

Tight-fitting respirators are designed to form a tight seal against the skin of the face or neck to effectively protect the person wearing it. Where the respirator seals against the face or neck must be clean shaven and not have anything else that may come between the skin and the sealing surface of the facepiece or in some other way interfere with how the respirator functions (e.g., long moustache hairs interfering with the exhalation valves).

Full-facepiece respirator users who wear glasses may need to have their respirator fitted with a lens holder or spectacle kit. The use of contact lenses may be permitted by the respiratory program administrator after they have looked at all relevant factors.

Facial Hair & Respirator Fitting

Farms with employees that are required to wear tight-fitting respirators may choose to create a clean-shaven policy. While the rate of hair growth can be different from person to person, clean shaven generally means having shaved within 12 hours of the work shift but no more than 24 hours. In many instances, facial hair has religious and cultural importance. If this applies to your operation, tight-fitting respirators may not be suitable and you may want to investigate other options, such as whether a Powered Air-Purifying Respirator (PAPR) with a hood may be suitable for the factors and conditions present on your farm.

IMPORTANT

Facial injuries, distinctive facial features, scars, dentures, piercings and prescription eyeglasses can sometimes make it challenging to fit someone with a respirator.

RESOURCES

You may find it helpful to refer to the following resources located at the end of this manual:

- **Appendix C: Facial Hairstyles and Ensuring a Proper Seal**
- **Appendix D: Clean Shaven Policy Example**

Why a Good Seal Is Critical

Particle size can vary, even among particles of the same type. Particles are measured in microns. The word micron is the shortened word for micrometer. A micrometer is used to measure the size of very small things such as those that cannot be seen by the naked eye. It is used to measure the size of a contaminate particle, as well as the size of the openings or pores of the filter media which gives you the filter media's micron rating.

The following table is intended to help you better understand particle size, how it is measured, how it is a factor in the rating of respiratory protective equipment, and why even small leaks in the seal of a respirator (such as those that result from facial hair) really do matter and place you at risk.

Particle	Size in Microns
Pollen (varies due to species)	2.5 – 200 [4]
Human hair diameter	100 [2]
Mould spore diameter	2 – 100 [3]
Skin cell	30 [2]
Welding fume particles (less than 10-30% are larger than 1 micron)	0.005 – 20 [5]
Fine particles that penetrate deep into the lungs	3 – 5 [6]
Mycobacterium tuberculosis (TB) diameter	Less than 1 to greater than 5 [1]
Bacillus anthracis spore (Anthrax infection) diameter	1.0 – 1.5 [1]
Coronaviridae (SARS-CoV, MERS-CoV & SARS-CoV-2)	0.12 [1]
Bunyaviridae (Hantavirus)	0.08 – 0.12 [1]
Adenovirus (respiratory infections)	0.07 – 0.09 [1]

1. (3M, 2020, p.4)
2. (University of British Columbia, n.d.)
3. (United States Environmental Protection Agency, 2021)
4. (Hiller, I., n.d.)
5. (Jenkins, N.T., Edgar, T.W., 2005)
6. (Dezube, 2021)

DID YOU KNOW?

NIOSH approved particulate respirators undergo a filter certification test, where the test conditions are considered to be more extreme than what would be found in most work environments. Some of these test conditions include:

- Air flow that imitates a high rate of work
- The most penetrating aerosol size (0.3 microns)
- Measurement of instantaneous, as opposed to average, penetration

When Fit Tests Are Performed

A fit test is first performed:

- After an employee has been screened
- After or during initial training
- Before using a respirator

Fit testing will need to be performed again when:

- There is a change to the respirator user's physical condition that could affect how the respirator fits, such as a change in weight, a change in facial features (e.g., broken nose), and a change to their dental features (e.g., missing teeth, new dentures, etc.).
- When there is a change in the respirator being used (e.g., change to make, model, or size).
- When the respirator user experiences significant discomfort while using the respirator or is having problems completing a successful user seal check.
- When there is a change in the personal protective equipment being used that may affect the respirator (e.g., addition or change of protective eyewear).
- At minimum, every two years (Canadian Standards Association, 2018, p.47).

IMPORTANT

"A sufficient variety of respirators shall be provided to ensure that the user has an opportunity to obtain a satisfactory fit because no single make, model, or size can be expected to fit all persons."

(Canadian Standards Association, 2018, p.47)

Clean shaven: Generally means having shaved within 12 hours of the work shift, but no more than 24 hours.

Filter media: The material that separates unwanted particles from what is being filtered, such as the air being breathed in.

Fit test: The use of a qualitative or quantitative measure to assess the fit of a particular make, model, and size of respirator on a respirator user.

Micron: Short for micrometer, a unit of measure. Used to measure the size of very small things, such as the size of a contaminate particle.

Make: This is the respirator manufacturer or the respirator manufacturer's brand name.

Model: This is the respirator's design, that is part of the manufacturer's range or series or respirators.

User seal check: "An action conducted by the respirator user to determine if the respirator is properly seated to the face (Occupational Safety and Health Administration, 2009, p.11)."

Never Force Fit a Respirator to Pass a Fit Test

Force fitting occurs when a failed fit test is repeated using the same respirator. During force fitting, the same respirator continues to be put back on and/or have other adjustments made to it, such as overtightening of the straps, until a fit test pass is achieved. While it is acceptable to adjust a respirator, it is important that comfort is maintained. Some problems with force fitting and overtightening a respirator include:

- That an overtightened respirator will not be comfortable to work in.
- When you overtighten a respirator, the elastic in the straps can break, making it difficult or impossible to achieve the same level of tightness that was needed to create a seal and pass the fit test.
- Overtightening a respirator can result in the facepiece becoming damaged and misshapen, which can result in leaks and contaminants being breathed in.

IMPORTANT

While it is acceptable to adjust a respirator, force fitting one is not. Having multiple respirator types and sizes on hand will help prevent the force fitting of respirators.

Types of Fit Tests

There are two types of fit testing; these are qualitative fit tests and quantitative fit tests. Let's look at these two types of tests in more detail.

Qualitative Fit Tests	Quantitative Fit Tests
• Low initial equipment cost • Low ongoing equipment care and maintenance • Relatively quick and easy to perform • Chance of employee deception • Limited protection-factor verification (maximum fit factor of 10) • Cannot be performed on respirators that will be used in highly toxic or IDLH environments • Relies on the fit tester's observations and opinion (subjective and may not be completely reliable) • Relies on the respirator user's ability to detect the testing agent (e.g., sense of taste or smell)	• High initial equipment cost • Moderate to high ongoing equipment care and maintenance (e.g., calibration) • No chance of employee deception • No protection-factor limit • Used for respirators that must be used in highly toxic and IDLH environments • Provides documentation with numerical results • Does not rely on the respirator user's ability to detect the testing agent
Who Can Perform Qualitative Fit Tests	**Who Can Perform Quantitative Fit Tests**
Can be performed by a qualified person on the farm or can be performed by qualified third-party.	Can be performed by a qualified person on the farm or can be performed by qualified third-party.
Where To Get More Detailed Information	**Where To Get More Detailed Information**
Detailed information relating to qualitative fit tests can be found in Annex B of CAN/CSA Z94-4-18 *Selection, use, and care of respirators.*	Detailed information relating to quantitative fit tests can be found in Annex C of CAN/CSA Z94-4-18 *Selection, use, and care of respirators.*

Qualitative Fit Tests (QLFT)

Qualitative fit testing uses an irritant, odour, or taste to check the seal on a tight-fitting respirator. This type of testing relies on the respirator user's ability to detect the testing agent. If the user can detect the testing agent, a proper seal has not been achieved; if the user cannot detect the testing agent, then a proper seal has been achieved. Different fit testing agents will have different testing methods and testing considerations.

Type of Qualitative Fit Test Grouped By Response	Type of Qualitative Fit Test Grouped by Testing Agent
Irritation fit test	Irritant smoke (stannic chloride)
Odour fit test	Banana oil (isoamyl acetate)
Taste fit test	Bitter aerosol or Saccharin

RESOURCE

You can refer to CAN/CSA Standard Z94.4-18 *Selection, use and care of respirators* and the manufacturer's specifications for more information on how to perform the various types of qualitative fit tests and the qualifications required to do so.

Quantitative Fit Tests

Quantitative fit tests use specialized equipment to measure the amount of test agent leaking into the facepiece of the respirator. The concentration of test agent outside the facepiece is compared to the concentration of test agent inside the facepiece. This comparison determines the level of protection provided by the respirator.

An employer who uses quantitative fit testing equipment in-house must ensure that the fit tester is able to competently calibrate the equipment, perform tests, identify invalid tests, calculate fit factors, and ensure that the equipment is in good working condition. The employer must also ensure that the fit testing equipment is maintained, calibrated and operated according to the manufacturer's instructions.

While there are many benefits to this type of fit testing and instances where this is the only type of fit testing that may be performed, the equipment requires a much higher initial investment and more ongoing care and maintenance than qualitative fit testing equipment. For these reasons, and others, many workplaces across Alberta choose to either perform qualitative fit testing methods in-house, rent quantitative fit testing equipment when required, or contract quantitative fit testing services as needed.

Quantitative Fit Test Comparison: With Facial Hair & Without Facial Hair

Have you ever wondered what effect a little bit of facial hair can have on the seal of a respirator? We performed a quantitative fit test on a subject before and after having shaved. Look at the images below and see for yourself.

RESOURCE

For more information on how to perform a quantitative fit test, refer to Annex C *Quantitative respirator fit tests (QNFT)* of CAN/CSA Standard Z94.4-18 S*election, use and care of respirators*, as well as the quantitative fit testing equipment manufacturer's instructions. Should your farm choose to purchase this type of equipment, ensure that it comes with initial training for its use and care from either the manufacturer or distributor.

Comfort: In terms of respirator comfort, respirator use is expected to cause a degree of discomfort. Being comfortable while wearing a respirator should be thought of as feeling reasonably physically at ease and without irritation, aching or pain.

Fit factor: "A quantitative estimate of the fit of a particular respirator to a specific individual, and typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn (Occupational Safety and Health Administration, 2009, p.8)."

Force fitting: When a failed fit test is repeated using the same respirator. In force fitting, the respirator continues to be put back on or have other adjustments made to it, such as overtightening of the straps, until a fit test pass is achieved.

Qualitative fit test (QLFT): A pass or fail respirator fit test method that relies on the respirator user's ability to sense a test agent; this is performed in order to assess if an adequate respirator fit has been achieved.

Quantitative fit test (QNFT): A respirator fit test method using specialized equipment to measure the amount of test agent leaking into the facepiece of a respirator. The concentration of test agent outside the facepiece is compared to the concentration of test agent inside the facepiece and is used to determine the level of protection provided by the respirator.

Test agent: A substance with irritant, odour or taste properties used to check the seal on a tight sealing respirator when performing a qualitative fit test; this type of testing relies on the respirator user's ability to detect the testing agent.

MODULE

7

Respirator Use Basics & How to Perform a Fit Test

In this module, readers will learn the steps to:

1. Put on and take off N95 respirators, elastomeric half-facepiece respirators and elastomeric full-facepiece respirators.

2. Perform user seal checks while wearing N95 respirators and elastomeric respirators equipped with particulate filters and cartridges.

3. General steps for performing a fit test and user competency check.

INTRODUCTION

This module begins with reviewing the steps for putting on and taking off three different types of respirators; these steps include how user seals checks are performed when wearing N95 respirators, as well as on respirators equipped with particulate filters and cartridges. This module ends with the general steps to perform a fit test and user competency check.

IMPORTANT

Always refer to the manufacturer's instructions before using a respirator, filters, cartridges, or canisters, as there may be differences between the general steps provided here and the specific instructions for that particular item.

HOW TO PUT A RESPIRATOR ON, TAKE IT OFF & PERFORM USER SEAL CHECKS

Putting On, Taking Off, and Performing User Seal Checks on an N95 Respirator

How to Put on an N95 Respirator

a) Prior to touching your respirator, you should wash your hands with soap and water. This is especially important if your hands look or feel dirty or you need to maintain sterile conditions.

b) Before putting on your respirator, perform a quick pre-use inspection. Look at the filtering facepiece and straps, checking for any signs of damage or defect.

c) Start by cupping the N95 respirator in the palm of your hand so that the inside of the facepiece is towards you and the straps are hanging below your hand.

d) Position the respirator under your chin with the nose piece up and secure the bottom strap around your neck and below your ears. Place the top strap around the top of your head and above your ears. Remember not to cross the straps.

e) Using both hands, place your fingertips on either side at the top of the metal nose clip and slide your fingers down. This will mold the nose clip to shape of your nose.

f) Perform a User Seal Check. This is important because it will help tell you whether or not you have achieved a proper fit. A User Seal Check needs to be done every time you put on a respirator.

   i) Start by placing both hands over the filtering facepiece of the respirator and take a quick, deep breath in. The respirator should collapse slightly. This is called a negative pressure user seal check.

   ii) Next, ensure both hands are completely covering the respirator and gently breath out. The facepiece should bulge slightly. This is called a positive pressure user seal check.

g) If at any point during either the positive or negative user seal check, you can feel air leaking between your face and the edges of the respirator, you do not have a proper seal.

   i) If air is leaking out around the nose, re-adjust the nosepiece and slide your fingers down both sides like you did earlier. Never pinch the metal nose clip.

   ii) If air is leaking at the edges of the facepiece, re-adjust the straps along the sides of your head.

   iii) Make small adjustments until a proper seal is achieved. If you cannot achieve a proper seal, you must ask someone for help. Do not use a respirator for which a user seal check cannot be completed successfully. Never enter a contaminated area or begin work without having a proper seal.

How to Take Off an N95 Respirator

a) Before you start to take off your respirator, stop and remind yourself not to touch the facepiece as it may be contaminated and, in turn, will contaminate your hands and anything that you touch after that. You should also be prepared to dispose of the respirator properly.

b) When taking off your N95 respirator, begin by pulling the bottom strap over your head followed by the top strap. This allows you to remove the respirator without touching it.

c) Dispose of used N95 respirators following your farm's procedures and the manufacturer's recommendations. Depending on the type of contaminant, this may require placing it in a plastic bag first or placing it directly in the trash. Never let a respirator that has been used rest on a table, hang from your neck, or be placed in your pocket as anything it touches may become contaminated. Remember to wash your hands after handling a used respirator.

Putting On, Taking Off, and Performing User Seal Checks on an Elastomeric Half-Facepiece Respirator

How to Put on an Elastomeric Half-Facepiece Respirator

a) Prior to touching your respirator, you should wash your hands with soap and water. This is especially important if your hands look or feel dirty.

b) Before putting on your respirator, perform a quick pre-use inspection. Check the straps, valves and gaskets for any loose, missing or damaged parts. Ensure the facepiece does not have tears and is in good condition.

c) Next, check that the filter or cartridge has not expired and that the gaskets of the respirator are in place. Fit the appropriate filter or cartridge onto the holder of the respirator. To do this, line the filter or cartridge up with the line on the respirator and give it a quarter turn clockwise until you feel it lock into place.

d) Check that the straps are reasonably loose since the last use. Cup the facepiece of the respirator in the palm of one hand so that the inside of the respirator is facing you, with the narrow top of the facepiece near your fingers and the wide bottom near your palm. The straps should be hanging unfastened below your hand.

e) Position the respirator under your chin and over your nose. With your other hand, pull the head harness over the crown of your head and gently tighten the top straps until it is in a stable position. Be careful not to twist the straps. If this occurs, remove the respirator, untwist the straps and repeat this step.

f) Hook the bottom straps together behind your neck. Make sure that the bottom strap is not twisted and lies flat against your neck. With one hand still on the facepiece, lightly tighten the upper straps followed by the lower straps two times using your other hand. After doing this, the straps of the respirator should be just tight enough for the respirator to remain in place as you take your hand away from the facepiece.

g) Using both hands, you will now tighten the straps again. This time it is done to secure the facepiece in position. Lightly tighten the upper straps followed by the lower straps until the facepiece of the respirator sits securely and comfortably in place. Keep an even tension on all of the straps and make sure the harness is centered on the top of your head.

i) Do not overtighten your respirator. Overtightening can result in the respirator not sealing properly, being uncomfortable or painful to wear, and it can cause damage to the respirator.

h) Perform a User Seal Check. This is important because it will help tell you whether or not you have achieved a proper fit. A User Seal Check needs to be done every time you put on a respirator.

i) Start by placing the palm of your hand over the exhalation valve cover and gently breath out. Hold your breath for at least 5 seconds to create a slight positive pressure inside the facepiece. The facepiece of the respirator should bulge slightly and you should not notice any air leaking between your face and the facepiece. This is called a positive pressure user seal check. When performing this type of check, be careful not to apply so much pressure that you change the shape of the facepiece.

Notice the facepiece before exhalation.

Notice the facepiece during exhalation.

- If you notice air leaking between your face and the face seal of the respirator or positive pressure cannot be maintained inside the facepiece for 5 seconds, reposition the respirator and make small adjustments to the straps until a more secure seal is achieved.

ii) The next type of user seal check is called a negative pressure user seal check and how it is performed may vary depending on the type of filter or cartridge being used. We will look at two different ways to perform a negative pressure user seal check.

- When using particulate filters (sometimes referred to as “pancake filters”), place your thumbs over the center of the filters, gently inhale and hold your breath for at least 5 seconds. The facepiece of the respirator should collapse slightly and you should not notice any air leaking between your face and the facepiece.

- If you are using cartridges, place the palms of your hands over the cartridge surface, gently inhale and hold your breath for at least 5 seconds. The facepiece of the respirator should collapse slightly and you should not notice any air leaking between your face and the facepiece.

Notice the facepiece before inhalation.

Notice the facepiece during inhalation.

i) In each case, if you notice air leaking between your face and the face seal of the respirator or the facepiece does not stay slightly collapsed for the 5 seconds, reposition the respirator and make small adjustments to the straps until a more secure seal is achieved.

j) If you cannot achieve a proper seal, you must ask someone for help. Do not use a respirator for which a user seal check cannot be completed successfully. Never enter a contaminated area or begin work without having a proper seal.

How to Take Off an Elastomeric Half-Facepiece Respirator

a) Before you start to take off your respirator, stop and remind yourself not to touch the cartridges or filters as they may be contaminated and, in turn will contaminate your hands and anything that you touch after that. You should also be prepared to dispose of the cartridges or filters properly

b) When taking off your elastomeric half-facepiece respirator, start by loosening the bottom straps and then the top straps. Hold the facepiece firmly and lift the respirator up, over your head and in front of you. This allows you to remove the respirator without touching the filters or cartridges.

c) Dispose of any used filters or cartridges following your farm's procedures and the manufacturer's recommendations. Depending on the type of contaminant, this may require placing them in a plastic bag first or placing them directly in the trash. Never let used cartridges or a dirty respirator rest on a table or other surface, as anything they touch may become contaminated. Remember to wash your hands after handling a used respirator.

d) This type of respirator will need to be cleaned regularly. Reusable respirators that do not get cleaned will not only have contaminants on them, but they can have an overgrowth of bacteria inside of them that could make someone sick and/or cause skin rashes. Lotions, aftershaves and powders should not be used in areas where the respirator seals to the face. Follow the manufacturer's recommendations for maintenance, disinfection, and storage of the respirator.

Putting On, Taking Off, and Performing User Seal Checks on an Elastomeric Full-Facepiece Respirator

How to Put on an Elastomeric Full-Facepiece Respirator

a) Prior to touching your respirator, you should wash your hands with soap and water. This is especially important if your hands look or feel dirty.

b) Before putting on your respirator, perform a quick pre-use inspection. Check the straps, valves and gaskets for any loose, missing or damaged parts. Ensure the facepiece does not have tears and is in good condition. Check the hard lens for any cracks, scratches, or damage, and ensure it is clear to see out of.

c) Next, check that the filter or cartridge has not expired and that the gaskets of the respirator are in place. Fit the appropriate filter or cartridge onto the holder of the respirator. To do this, line the filter or cartridge up with the line on the respirator and give it a quarter turn clockwise until you feel it lock into place.

d) Check that the straps are reasonably loose since the last use. Cup the facepiece of the respirator in the palm of one hand so that the inside of the respirator is facing you.

e) Position the respirator under your chin and over your nose. With your other hand, pull the head harness over the crown of your head and gently tighten the top straps until it is in a stable position. Be careful not to twist the straps. If this occurs, remove the respirator, untwist the straps and repeat this step.

f) With one hand still on the facing piece, lightly tighten the upper straps followed by the lower straps two times using your other hand. After doing this, the straps of the respirator should be just tight enough for the respirator to remain in place as you take your hand away from the facepiece.

g) Using both hands, you will now tighten the straps again. This time it is done to secure the facepiece in position. Lightly tighten the upper straps followed by the lower straps until the facepiece of the respirator sits securely and comfortably in place. Keep an even tension on all of the straps and make sure the harness is centered on the top of your head.

   i) Do not overtighten your respirator. Overtightening can result in the respirator not sealing properly, being uncomfortable or painful to wear, and it can cause damage to the respirator.

h) Perform a User Seal Check. This is important because it will help tell you whether or not you have achieved a proper fit. A User Seal Check needs to be done every time you put on a respirator.

i) Start by placing the palm of your hand over the exhalation valve cover and gently breath out. Hold your breath for at least 5 seconds to create a slight positive pressure inside the facepiece. The facepiece of the respirator should bulge slightly and you should not notice any air leaking between your face and the facepiece. This is called a positive pressure user seal check. When performing this type of check, be careful not to apply so much pressure that you change the shape of the facepiece.

- If you notice air leaking between your face and the face seal of the respirator or positive pressure cannot be maintained inside the facepiece for 5 seconds, reposition the respirator and make small adjustments to the straps until a more secure seal is achieved.

ii) The next type of user seal check is called a negative pressure user seal check and how it is performed may vary depending on the type of filter or cartridge being used. We will look at two different ways to perform a negative pressure user seal check.

- When using particulate filters (sometimes referred to as "pancake filters"), place your thumbs over the center of the filters, gently inhale and hold your breath for at least 5 seconds. The facepiece of the respirator should collapse slightly and you should not notice any air leaking between your face and the facepiece.

Notice the facepiece before inhalation.

- If you are using cartridges, place the palms of your hands over the cartridge surface, gently inhale and hold your breath for at least 5 seconds. The facepiece of the respirator should collapse slightly and you should not notice any air leaking between your face and the facepiece.

During inhalation; notice how the facepiece is slightly collapsed.

i) In each case, if you notice air leaking between your face and the face seal of the respirator or the facepiece does not stay slightly collapsed for the 5 seconds, reposition the respirator and make small adjustments to the straps until a more secure seal is achieved.

j) If you cannot achieve a proper seal, you must ask someone for help. Do not use a respirator for which a user seal check cannot be completed successfully. Never enter a contaminated area or begin work without having a proper seal.

How to Take Off an Elastomeric Full-Facepiece Respirator

a) Before you start to take off your respirator, stop and remind yourself not to touch the cartridges or filters as they may be contaminated and in turn will contaminate your hands and anything that you touch after that. You should also be prepared to dispose of the cartridges or filters properly.

b) When taking off your elastomeric full-facepiece respirator, start by loosening the bottom straps and then the top straps. Hold the facepiece firmly and lift the respirator up, over your head and in front of you. This allows you to remove the respirator without touching the filters or cartridges.

c) Dispose of any used filters or cartridges following your farm's procedures and the manufacturer's recommendations. Depending on the type of contaminant, this may require placing them in a plastic bag first or placing them directly in the trash. Never let used cartridges or a dirty respirator rest on a table or other surface, as anything they touch may become contaminated. Remember to wash your hands after handling a used respirator.

d) This type of respirator will need to be cleaned regularly. Reusable respirators that do not get cleaned will not only have contaminants on them, but they can have an overgrowth of bacteria inside of them that could make someone sick and/or cause skin rashes. Lotions, aftershaves and powders should not be used in areas where the respirator seals to the face. Follow the manufacturers recommendations for maintenance, disinfection, and storage of the respirator.

GENERAL STEPS WHEN PERFORMING A QUALITATIVE FIT TEST

This section provides a general overview of how to perform a qualitative fit test while also checking the respirator user's competency. When performing a fit test, it is recommended that you also refer to the procedure found in CAN/CSA Standard Z94.4-18 *Selection, use and care of respirators* and as well as the fit test equipment manufacturer's instructions.

Pre-Fit Test Checklist

Before someone gets fit tested, check the following:

- ☐ Ensure the respirator user has been screened, received a health care provider's approval (if required), and has received the necessary training up to this point.
- ☐ Ensure the respirator user has been fitted with their own respirator or has a clean respirator made available to them. Respirators used for fit testing that are not assigned to individuals must be cleaned and sanitized before being used again.
- ☐ Verify that the person being fit tested does not have any facial hair, piercings or other personal accessories that may come between their skin and the surface of the respirator seal; if they do, they cannot be fit tested.
- ☐ Verify that the person is wearing any personal protective equipment and other items that they would normally wear during work while using a respirator (e.g., protective eyewear, hard hat, bump cap, hearing protection, etc.). This is done to ensure the respirator seal is not compromised and provides a check on the user's comfort level.

General Considerations When Performing a Fit Test & User Competency Check

1. Screening Verification & Threshold Screening

This step is very important, as it verifies that the respirator user has been screened and that there is nothing which may prevent them from using a respirator or from being fit tested.

a) Prior to having the respirator user put on their respirator, perform a sensitivity test to ensure that the respirator user can detect the test agent. Some individuals may not be sensitive to the test agent. If a user cannot detect the test agent, use an alternative test agent or method.

2. Initial Steps

The fit tester will observe and ensure that the following is being performed to an acceptable level:

a) The respirator user as they inspect the components of their respirator.

b) The respirator user as they fit the respirator with filters or cartridges, as applicable.

c) The respirator user as they put on their respirator and adjust it for a comfortable but tight fit.

d) The respirator user as they perform a successful positive user seal check and negative user seal check.

3. Respirator Comfort Assessment

The fit tester will observe and ensure that the following is being performed to an acceptable level:

a) The respirator user should wear the respirator for at least 5 minutes before the test, during which time the fit tester will review the fit test procedure with the respirator user.

   i) This step allows the respirator user to understand the procedure, ask any questions they may have, and to better assess the comfort level of the respirator (such as the strap tension and pressure points from additional personal protective equipment that must be worn with it).

b) At the end of the time period, the respirator user will provide verbal confirmation of their comfort level; it is also acceptable to assess the comfort level of the respirator after the respirator user has passed the fit test.

4. Perform the Fit Test Exercises

The fit tester should follow their fit testing training and the manufacturer's instructions relating to the fit test equipment and fit testing agent.

During this step, it is important to remember the following points:

- Each exercise must be performed for at least 30 seconds.
- If at any time the respirator user detects the test agent, the fit tester must stop and attempt to identify the reason for and location of the leak and measures will need to be taken to correct this, such as having the respirator user make adjustments to the respirator, using a different size, model, or make of respirator.

Exercise 1: Repeat user seal checks

- The respirator user will again be required to successfully perform a positive and negative user seal check.

Exercise 2: Normal breathing exercise

- The fit tester will instruct the respirator user to breath normally for the duration of this exercise.

Exercise 3: Deep breathing exercise

- The fit tester must verify that the breaths taken are both deep and regular.

Exercise 4: Turning head from side-to-side exercise

- The fit tester must ensure that the movement is complete and within the respirator user's comfortable range of motion.
- The respirator user will need to be told to inhale and exhale while the head is at either side and to avoid having the respirator make contact with their shoulder.

Exercise 5: Nodding head up and down exercise

- The fit tester must ensure the movement is complete and within the respirator user's comfortable range of motion.
- The respirator user must be advised to inhale while their head is fully up and to exhale when their head is fully down, and to avoid the respirator contacting their chest.

Exercise 6: Talking exercise

- The respirator user must speak loudly and slowly enough to be understood for the duration of the exercise.
- The fit tester will instruct the respirator user to recite the "Rainbow Passage," count, recite the alphabet, or talk about a subject related to their work activities. This will help ensure that a proper seal can be maintained while the respirator user is talking during the course of work.
    - **Important:** The respirator user's reading level and English language skills should be considered when selecting the speaking activity to be used.
- The Rainbow Passage:
  "When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long, round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When people look for something beyond their reach, their friends say they are looking for a pot of gold at the end of the rainbow."

Exercise 7: Bending over exercise

- The fit tester will instruct the respirator user to bend at the waist while trying to keep their head parallel to the floor, inhaling two times while at each extreme position. This movement should be repeated at a comfortable pace for the duration of the exercise.

Exercise 8: Normal breathing exercise

- Again, the fit tester will instruct the respirator user to breathe normally for the duration of this exercise.

(Adapted from Occupational Safety and Health Association, 2011, pg.81-88 to align with CAN/CSA Standard Z94.4-18 *Selection, use and care of respirators*)

RESOURCES

Refer to Annex B: Qualitative respirator fit tests (QLFT) of CAN/CSA Z94.4-18 *Selection, use and care of respirators* as it is a mandatory part of the standard and addresses the recognized fit methods.

Fit test training can be obtained online from 3M Canada at https://www.3mcanada.ca/3M/en_CA/worker-health-safety-ca/training-courses-and-fit-testing/.

Many resource videos can be found online, such as Allegro Industries Bitter & Sweet Fit Test Kits (Instructional) Video.

MODULE

8

Inspection, Cleaning, Maintenance & Storage of Respirators

In this module, readers will:

1. Gain a general understanding **of how to inspect a respirator.**
2. Learn the basic steps of cleaning **an elastomeric respirator.**
3. Learn how to care for and **store respirators.**

INTRODUCTION

A respirator that is well cared for will protect you far better and last much longer than one that is not. In this section, you will learn about inspection, cleaning, maintenance, and storage measures that should be taken to ensure your respirator continues working as it is intended.

INSPECTION

Respirators should be inspected before and after each use, with the exception of single-use respirators as they will only require a pre-use inspection. Respirators will also need to be inspected in accordance with the manufacturer's instructions.

Common, basic parts of a respirator that should be looked at include:

Facepiece

- Check for holes, tears, stiffness, or dirt
- Check for cracked, scratched or loose lenses and missing gaskets
- Ensure facepiece is not warped or oddly shaped

Head Strap & Harness

- Check for frayed, torn or knotted straps
- Look for signs of excessive wear
- Look for cracked plastic on the head harness
- Ensure clips or buckles are in good condition

Inhalation & Exhalation Valves

- Ensure the valve and valve seat are free of dust or dirt
- Check for cracks or tears
- Ensure the valves are lying flat, not stuck, and in good condition

Filters & Cartridges

- Ensure that the filters or cartridges are the correct type
- Check the expiration dates and the ESLI indicator, if present
- Check for cracks, dents, tears, or other signs of damage
- Inspect both the filter or cartridge threads and facepiece threads for wear

Air Supply Systems

- Check the breathing air quality or grade
- Check the condition of hoses
- Ensure that the hose connections are clean and undamaged
- Check the valve and regular settings and function

(Occupational Safety and Health Association, 2011, p.109)

IMPORTANT

Any respirator that does not pass an inspection must be removed from service!

CLEANING REUSABLE RESPIRATORS

Reusable respirators must be cleaned following the manufacturer's directions. Cleaning is done to remove dirt, kill bacteria and keep the respirator in good, sanitary condition. Reusable respirators that do not get cleaned can have an overgrowth of bacteria and even cause skin rashes.

When going on a break, hypo-allergenic respirator wipes may be used on the facepiece seal and inside the respirator to help keep it clean. This is only a temporary measure, as the respirator will still need to be properly cleaned and sanitized.

Why Regularly Cleaning Your Reusable Respirator Inside & Outside is Essential

A small study was conducted in 2020 at the Kindai University Faculty of Medicine in Osaka, Japan, using experimental protocols approved by the Institutional Biosafety Committee of Kindai University. While this study was performed on face masks, it is reasonable to expect similar results with respirators.

In this study, the following were identified:

- Bacterial colony numbers were greater on the inside of the face mask than the outside
- Fungal colonies were greater on the outside of the face mask
- The longer a face mask was used, the number of fungal and bacterial colonies significantly increased
- The following microbes were identified on the face masks: *Staphylococcus epidermidis, Staphylococcus aureus, Cladosporium, Bacillus cereus, Staphylococcus saprophyticus, Aspergillus, and Microsporum.*

(Park, AM, Khadka, S., Sato, F. et al, 2022)

General Procedure for Cleaning and Sanitizing Elastomeric Respirators

1. Remove the filters or cartridges from the facepiece; dispose of them according to the farm's procedure, or if they are still within their service life, cover the surface with tape (if appropriate). Place the filters or cartridges in a resealable bag to prevent them from contaminating other items and to help keep them dry.
    - Do not put damp filters or cartridges in a sealed bag for later use!
2. Remove the head harness, gaskets, and valves from the facepiece.
3. Gently wash the facepiece in warm water no hotter than 43°C/110°F. Water hotter than this temperature may cause the facepiece to lose its shape. Use a mild soap designed to kill bacteria or a cleansing product designed specifically for this purpose and that is approved for use by the respirator manufacturer.
    - Specially designed cleaners are available through most safety equipment suppliers. Never use solvents or scented products to clean a facepiece, as these products may damage plastic and rubber parts.
4. A soft to stiff-bristle (not wire) scrub brush may be used on difficult to remove materials.
5. Rinse the facepiece in clean, warm water no hotter than 43°C/110°F. Ensure there is no soap residue left on the facepiece as it may result in a skin rash or cause the valves to seal shut.
6. If the cleansing product used did not contain a disinfecting agent, and if permitted by the manufacturer, soak all respirator parts for 2 minutes in a hypochlorite solution made by adding approximately 1 mL of laundry bleach (5-6% chlorine) and 1 L of warm water no hotter than 43°C/110°F, and rinse in warm water again.
7. Air dry the facepiece on a clean surface or hang it in a clean, protected place. Dry the facepiece in a way that will not damage the facepiece or cause it to lose its shape. A clean, soft, lint free cloth may also be used to help dry it.
8. Gently wash valves or gaskets in a similar manner. Allow them to air dry on a flat surface. Any curled or damaged valves will need to be replaced with new ones. Replacement valves are typically available through most safety equipment suppliers.
9. Carefully reassemble the respirator. Ensure all pieces are in the correct positions and that the respirator works properly.

(Occupational Safety and Health Administration, 2009, p.38)

IMPORTANT

Do not attempt to clean single-use respirators, filters or cartridges!

KEY POINTS TO REMEMBER

In addition to the steps outlined in the procedure that you have just read, below are very important points to keep in mind as well.

- When rinsing your respirator, running water is preferred. Thorough rinsing is required as residue from detergents and disinfectants can cause skin irritation and damage respirator parts.
- Do not store your respirator until it is completely dry!
- In most cases, respirators will be assigned to individuals. The sharing of respirators is discouraged, however, if in such instances as having respirators used only for fit testing purposes, these respirators must be properly cleaned and sanitized between respirator users.
- Respirators that are designated for emergency use must be cleaned and sanitized after every use.
- Respirators used where there are highly toxic contaminants present may require special cleaning and sanitizing procedures.

MAINTAINING REUSABLE RESPIRATORS

A respirator needs to be properly maintained in order to continue protecting the person wearing it. The manufacturer's instructions are the best source of information for how this should be done. Depending on the type of respirator used, some manufacturer approved replacement parts (such as valves) can be easily installed on the farm. Never use unapproved parts as they void the respirator's NIOSH approval and may not offer adequate protection. The farm will need to keep enough of these replacement parts or extra respirators available should a respirator need to be taken out of service.

More complicated repairs and maintenance must only be performed by qualified individuals. Air-purifying respirators (PAPRs) and self-contained breathing apparatus (SCBA) with regulators, alarms and monitors are examples of respirators that would require maintenance or repairs to be performed either by the manufacturer or another qualified person with specialized training. Attempting to perform repairs and maintenance on the farm could result in damaged or malfunctioning equipment which could put the respirator user's health or even life at risk.

STORING REUSABLE RESPIRATORS

Respirators should be stored in a sanitary and protected manner. In many instances, a clean and dry coffee can with a lid, a resealable poly bag, or another type of protective respirator bag which can then be kept in a cupboard or locker works well.

Storing cartridges in sealed bags will help prevent them from absorbing contaminants while in storage and shortening their service life. Sealing filters with duct tape may be a reasonable step to help prevent toxic contaminants from coming loose from the filters and getting into the air or the facepiece. Sealing the filters or cartridges with duct tape and/or placing them in a plastic bag before disposal may be appropriate, especially if they have been used in an area where something like hantavirus may have been present.

Respirators should be stored in a way that protects them from:

- Dust & dirt
- Contaminants
- Impacts
- Extreme temperatures
- Excessive moisture
- Deformation
- Oils, greases, & solvents
- Damaging chemicals

(Occupational Safety and Health Administration, 2009, p.19)

MODULE

9

Recordkeeping

In this module, readers will:

1. Gain an understanding of **the types of records the farm will need to maintain in relation to their respiratory protection program.**

INTRODUCTION

Recordkeeping is an important part of any respiratory protection program. Good recordkeeping practices will help you determine if you are doing everything you should be, assess how well the program is working, and assist you in making any necessary adjustments. Recordkeeping is also an important aspect of being able to prove due diligence should an issue ever arise.

KEY POINT TO REMEMBER

Please remember that the term *Respiratory Protection Program* is used in this manual rather than Code of Practice. This has been done to make the manual easier to read and to align it with CAN/CSA Standard Z94.4-18, *Selection, use and care of respirators.*

RESOURCE

The AgSafe Alberta FarmSafe Plan Manual and free, online FarmSafe Plan Learning Program can provide you with a better understanding of what should go into developing the different parts of a health and safety program, which can include a respiratory protection program. Visit **agsafeab.ca** to learn more.

RESPIRATORY PROTECTION PROGRAM RECORDS

The farm will need to keep records that relate to and support the farm's respiratory protection program. Alberta OHS legislation directly references CAN/CSA Standard Z94.4 S*election, use and care of respirators* and it is recommended to align this part of your respiratory protection program with it. Some of the records that will need to be kept are outlined as follows.

Hazard Assessments

Hazard assessments are an essential part of a respiratory protection program. Hazard assessments are completed before the work begins and regularly thereafter. Documenting hazard assessments and keeping them will support your respiratory protection program as well as your due diligence.

Respiratory Protective Equipment Selection Records

Any records which would support the respirator selection process should be maintained. Examples of these types of records may include:

- Hazard assessments
- Manufacturer's recommendations
- Related standards and legislation
- Any worksheets and flow charts used
- What the filter and/or cartridge change out schedule is and supporting information as to why (e.g., manufacturer's recommendations)

Respirator User Screening Records

The respirator user screening records should be securely stored as these are a type of confidential record.

Training Records

The training records for respirator users should list the content and type of training provided, the dates that it took place, a record of completion, and some form of competency check.

The qualifications, training records, certifications, etc., of the person providing the training or assisting the trainer should also be maintained.

The CAN/CSA Standard Z94.4-18 S*election, use and care of respirators* recommends that training records be maintained at least throughout the course of the individual's employment or a minimum of 10 years from the date of creation. This corresponds with doctors and hospitals that maintain records of all patients for at least 10 years from the last record of entry, though some may keep the records longer.

Fit Testing Records

The following information should be recorded and maintained on the fit test records:

- Name of the respirator user
- Date of the fit test (or tests)
- Specific make, model, and size of respirator
- Type of fit test method and agent used
- Pass/fail criteria of the fit test
- List of additional personal protective equipment worn during the fit test
- Notes on any restrictions (e.g., facial hair, eyewear, unique facial features)
- Name of the fit tester
- Results of the comfort assessment and the respirator user's responses to the questions asked
- Documentation of the respirator user's competency (e.g., pre-use inspection, putting on/taking off the respirator, performing positive and negative user seal checks)
- Documentation regarding any unsuccessful fit tests and the reason(s) for them
- Documentation of the maintenance, calibration, and repair of the fit test equipment (if applicable)

Inspection, Cleaning, Maintenance and Storage Records

The following information should be recorded and maintained:

- When filters or cartridges have been changed out and after how many hours of use
- When any respirator parts have been replaced and by whom
- When respirators have been taken out of service, why they were taken out of service and what was done (e.g., disposed of or repaired)
- When respirators have been cleaned and sanitized, and who did it
- Assigned storage lockers

Program Evaluation Records

These are records that would show ongoing efforts to ensure respirator users are protected from the hazards and that the respiratory protection program is being appropriately managed. Examples of evaluation records may include:

- Roles and responsibilities relating to the respiratory protection program and if these have been met
- Any additional or re-training that needed to be provided
- Number of breakthrough exposures reported
- Occupational illnesses or injuries reported
- Instances of non-compliance with the respiratory protection program (e.g., someone caught not wearing their respiratory when it was required)
- Respirator user opinion surveys
- Program audit records

(Adapted from Occupational Health and Safety Administration, 2011, p.102-111)

Audit: An audit is an evaluation of an operation's health and safety program or a part of it (e.g., respiratory protection program) against an approved standard.

Records: A form of evidence that provides information about the farm's activities, what it has done and even what it plans to do. Records can include paper documents, digital records, emails, photographs, etc.

Recordkeeping: The management of records, such as what documents are created, where they are stored, how they are used, who can access them, and finally when and how they are disposed of.

Appendix A: Respirator Quick Use Reference Guide

The following are general points to remember while using a respirator or supervising someone who is using a respirator:

1. The respirator user and supervisor should always check that the correct type of respiratory protective equipment is being used for the task and work environment.
2. Only individuals who have been trained, fit tested, and deemed competent should perform work that requires a respirator to be worn.
3. Respirators must be inspected by the respirator users before being worn to ensure they are in good working order.
4. The work environment and workers should be monitored for any changes. This is done so that if a problem does arise, it is identified right away and addressed quickly. This can include monitoring oxygen levels, toxic gas levels, temperatures, worker fatigue, stress levels, etc.
5. Any issues experienced with a respirator must be reported to the supervisor and program administrator; part of this process includes ensuring that the issue is properly documented, investigated, and that actions are taken to correct the issue. Reportable issues may include equipment defects, breakthrough on cartridges, possible exposures, newly identified respiratory hazards, etc.
6. Respirators can be wiped out using specially designed respirator wipes but must also be cleaned regularly to prevent illness and keep the respirator in good condition.
7. Respirator users must immediately leave the work area if:
    a) A cartridge breakthrough occurs.
    b) There is a change in breathing resistance.
    c) The facepiece of the respirator is or may be leaking.
    d) The respirator, filter, or cartridge needs to be replaced.

IMPORTANT

Any respirator that does not pass an inspection must be removed from service!

Appendix B: Respirator Selection Table

Respirator Type	Respirator Sub-Type	Assigned Protection Factor	Limitations
Airline Types [2] Includes: Airline respirators Hoods Helmets Suits	Demand mode Half-Facepiece	10	Hose limits the workers' mobility Only positive-pressure[1] equipped units with an escape air-supply bottle may be used in IDLH environments.
	Demand mode Full-facepiece	100 [3]	
	Positive pressure [1] Half-facepiece	50	
	Positive pressure [1] Full-facepiece	1000	
	Helmet/Hood [4]	1000	
	Loose-fitting facepiece [4]	25	
Self-contained breathing apparatus (SCBA)	Demand mode Full-facepiece	100 [3]	Use time is limited by cylinder capacity. Units are heavy and may restrict movement in small spaces. Only *positive-pressure* units with at least a 30 minute capacity and a low capacity warning alarm may be used in IDLH situations.
	Pressure demand (positive pressure)	[5]	
Particulate filter Chemical cartridge Canister Combination cartridge (particulate & chemical)	Half-facepiece	10	Unacceptable for protection in IDLH conditions or oxygen deficient atmospheres. Choice of filter depends on identity of contaminant and, for particulate respirators, the presence of oil.[6] Service life depends on factors such as the type and amount of filtering medium, concentration of contaminant, temperature and humidity.
	Full-facepiece	100 [7]	
Powered air-purifying respirator	Half-facepiece	50	
	Full-facepiece	1000	
	Helmet/Hood [8]	1000	
	Loose-fitting facepiece [8]	25	

Notes:

1. Positive pressure refers to pressure-demand mode or continuous-flow mode respirators.
2. Air used for atmosphere-supplying respirators must be of a quality that complies with Table 1 of CSA Standard Z180.1-00, Compressed Breathing Air and Systems, and does not contain a substance in a concentration greater than 10% of the applicable Occupational Exposure Limits listed in Alberta's Occupational Health and Safety Code. (This does not apply to substances already listed in Table 1 of the CSA Standard.)
3. Assigned protection factors listed are from CSA Standard Z94.4-02 for a respirator that has been fitted using quantitative fit-test methods according to the standard. If qualitative fit testing is done, the assigned protection factor for demand-mode airline respirators and SCBA is 10.
4. Need not be fit tested.
5. When potential hazardous concentrations can be estimated, an APF of no greater than 10,000 should be used.
6. NIOSH has classified air-purifying particulate filters as "N" (Not oil resistant), "R" (oil Resistant), or "P" (oil Proof). You can obtain these filters with filtering efficiencies of 95%, 99% or 99.97%.
7. Assigned protection factors listed are from CSA Standard Z94.4-02 for a respirator that has been fitted using quantitative fit-test methods according to the standard. If qualitative fit testing is done, 10 is the assigned protection factor for a full facepiece air-purifying respirator.
8. Need not be fit tested.

Adapted from the Government of Alberta, *Respiratory Protective Equipment: An Employer's Guide*,

Table 1. Air-Supplying Respirators and Table 2. Air-Purifying Respirators (Alberta Government, 2020, p.4-5)

Appendix C: Facial Hairstyles & Ensuring a Proper Seal

With Tight-Fitting Respirators

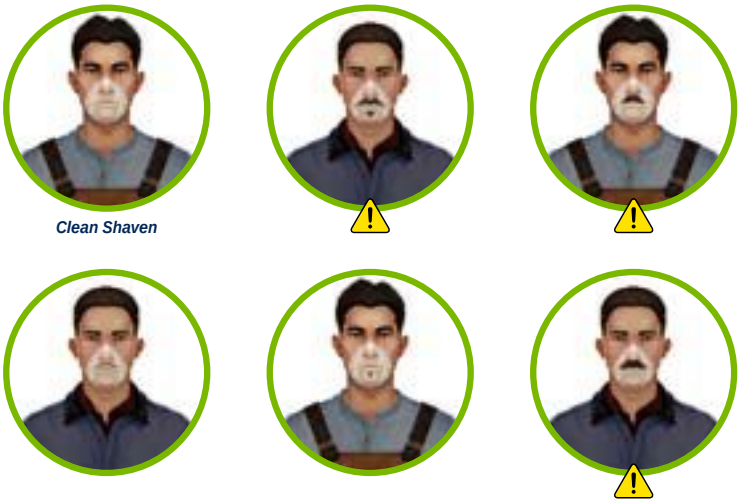
To help ensure that a respirator user is protected from respiratory hazards, a proper seal must be achieved. To ensure a proper seal can be achieved, the respirator user cannot have anything interfering with where the respirator seals against the skin of the face.

Be mindful that while some facial hair styles may not interfere with the seal, they may interfere with exhalation valve function should hairs come into contact with the valves.

Other factors that may interfere with the seal of a respirator:

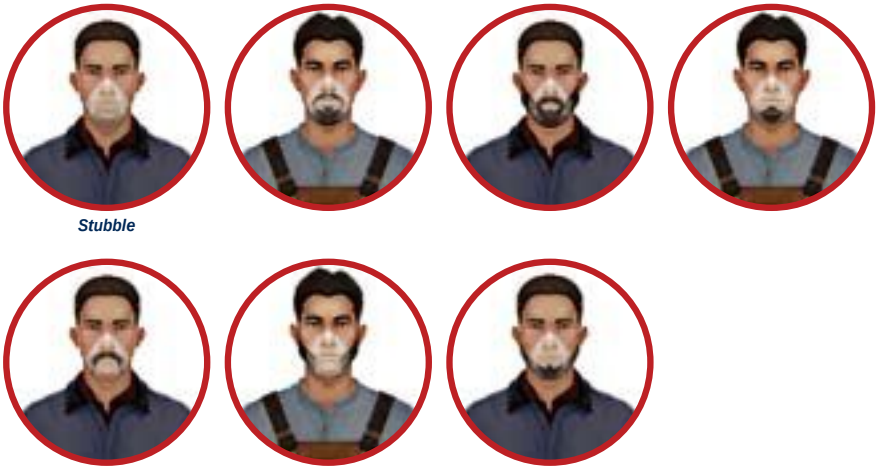
- Piercings/facial jewelry
- Unique facial shapes or features (e.g., very angular faces, facial depressions, nose shape, or moles)
- Scars/scar tissue
- Other foreign bodies
- Cosmetics or lotions

Proper seal may be achieved



Clean Shaven

Proper seal cannot be achieved



Stubble

Appendix D: Clean Shaven Policy Example

This sample policy is to be used as a general, non-specific example only. The best and most effective policies are those developed by key members of the farm team, including members from the health and safety committee (if applicable) and employees who will be required to wear respirators & follow this policy. Taking this approach keeps the policy applicable to your specific operation and makes it more likely to be followed.

RESOURCE

A downloadable and customizable Clean Shaven Policy template can be found in the **Resources** section of the AgSafe Alberta website.

Clean Shaven Policy

Disclaimer: This document is intended to be a resource document only. The farm will need to customize it and make it farm-specific to address the particular needs, factors, applicable legislated requirements, etc.

Helpful Information: You can combine your statements into paragraph form, or you can keep everything in point form if you prefer. Remember to replace FARM with the name of your farm business. This policy structure is relatively generic, so you can add or delete sections (e.g., Scope) as appropriate. Be sure to write everything in plain language that anyone can understand and avoid using safety related jargon where possible. Be sure to remove the steps written in italicized text.

1.0 Policy Statement

Step 1: Explain why the Clean Shaven Policy is important.

1.1 Tight-fitting respirators must be worn while performing certain jobs or tasks on the farm.

1.2 In order for a respirator to adequately protect the person wearing it, nothing can come between the face seal of the respirator and the skin of the person wearing it.

1.3 This clean shaven policy has been adopted based on existing and potential exposure to respiratory health hazards present in the poultry barn.

2.0 Purpose

Step 2: Explain the goal or purpose of the Clean Shaven Policy.

2.1 Its purpose is to ensure that all individuals who are or may be required to wear a tight-fitting respirator on **The Farm** will be able to achieve a proper respirator seal and good valve function free from interference by facial hair.

2.2 The poultry barn contains organic dust made up of feed, fecal particles, feather barbules, skin debris, fungal matter, spores, bacteria, viruses, and other matter. The poultry barn also contains ammonia, especially during the winter months.

2.3 In addition to the engineering and administrative hazard controls in place (e.g., mechanical ventilation and work rotations), the use of appropriate respiratory protection and ensuring a proper seal between the respirator and the skin of the face/neck reduces the potential for exposure to the respiratory health hazards present which in turn reduces the risk of illness and injury to the respiratory system.

3.0 Scope

Step 3: Detail who the Clean Shaven Policy applies to.

3.1 Family members, employees, contractors, and visitors who will be entering the poultry barn must arrive at **The Farm** meeting the standards set out in this policy.

3.2 Anyone who is a designated member of **The Farm's** Emergency Response Team must ensure that they meet the requirements of this policy at all times.

4.0 Definitions

Step 4: Include any definitions which someone might not know.

4.1 **Clean shaven:** Having no visible whiskers or stubble between the sealing surface of the respirator facepiece and the skin; this means that goatees are not allowed, moustaches must be trimmed to the corner of the mouth, sideburns cannot extend below the earlobe, and for many (depending on the rate of hair growth) being clean-shaven within the previous 12 hours to ensure that facial hair does not interfere with the sealing surface of the respirator.

4.2 **Corrective Action:** A planned activity or set of planned activities done for the sole purpose of permanently resolving a problem.

4.3 **Employee:** Permanent, temporary, casual or seasonal employees on **The Farm's** payroll and is not classified as a family member.

4.4 **Employer:** A person or company that provides a job that pays wages or a salary to one or more people or a person designated by an employer to be their representative.

4.5 **Family member:** Someone who is related to a shareholder, sole proprietor or partner such as a spouse or adult interdependent partner or someone who related to a shareholder, sole proprietor or partner by blood, marriage, adoption, or by virtue of an adult interdependent relationship.

4.6 **Non-conformance:** To act in way that does not meet with standard, expectation or other known condition as it relates to this policy.

4.7 **Personal Protective Equipment (PPE):** Anything worn by someone to reduce their exposure to a hazard.

4.8 **Respirator:** A type of personal protective equipment worn by a respirator user that protects them from breathing in airborne contaminants and/or inhaling a hazardous atmosphere.

4.9 **Supervisor:** Anyone who is in a leadership position or position of authority over a worksite or a worker. Supervisor is a function, not necessarily a job or job title.

4.10 **Visitor:** Someone on **Farm** property on a short-term or temporary basis and is not related to an owner by blood, marriage, adoption, or virtue of an adult interdependent relationship and is not in an adult interdependent relationship or a spouse of an owner.

5.0 Responsibilities

Step 5: Outline who is responsible for what.

5.1 **The FARM/Employer will:**

- Ensure family members, employees, contractors, and visitors receive an orientation prior to starting work or entering any work areas, which includes being made aware of this policy and its requirements.
- Ensure this policy is being actively enforced by supervisors and that non-conformances are being addressed in a fair and appropriate manner.
- Ensure this policy is regularly reviewed to ensure relevance and accuracy.

5.2 **The Human Resources Manager will:**

- Work with Supervisors to ensure that non-compliance matters are handled promptly, fairly, and in accordance with **The Farm's** Disciplinary Action Policy.
- Ensure the confidential handling and storage of any documentation relating to non-conformances and disciplinary actions taken.

5.3 **Supervisors will:**

- Use observations tools, informal workplace inspections, and evaluations to ensure respirator users are following this policy and the definition of clean shaven provided.
- Document any matters relating to non-conformance in an objective and factual manner.
- Work with the Human Resources Manager to promptly and fairly address matters relating to non-conformance with this policy in accordance with **The Farm's** Disciplinary Action Policy and its provisions relating to the use of required personal protective equipment (PPE).

5.4 **Family members, employees, emergency response team members and visitors who are or may be required to wear respirators will:**

- Follow the requirements of this policy by ensuring they are clean shaven at the start of each work shift and prior to fit testing.

5.5 **Contractors will:**

- Wear approved respiratory protection whenever they are in the poultry barn.
- Follow Alberta Occupational Health and Safety legislation, including evaluating health hazards for their employees, and identify where respirators may be required for the work they will be performing.
- Any contractor and/or their employees who are or maybe required to wear respirators while on **The Farm** must be clean shaven as per this policy.

6.0 Policy Standards/Work Rules

Step 6: Outline what the policy standards/work rules are.

6.1 All individuals who are or may be required to wear a tight-fitting respirator will arrive for their work shift in a manner that:

a) Fits the definition of clean shaven as explained in this policy, and,

b) Is classified as acceptable by Annex P Illustrations of acceptable and unacceptable facial hair for tight-fitting respirators from CAN/CSA Z94.4-18 *Selection, use and care of respirators*.

7.0 Training

Step 7: Outline the training needed to support this policy.

7.1 Employees will receive training on this and other applicable policies prior to starting work.

7.2 Visitors and contractors will receive this information prior to going on farm, as appropriate.

8.0 Monitoring & Review

Step 8: State how often this policy will be reviewed.

8.1 Review periods will not exceed three years, and reviews may occur more often if found to be appropriate.

9.0 Relevant Legislation

Step 9: Include any applicable legislation here.

9.1 Alberta Occupational Health and Safety Code, Part 18: Personal Protective Equipment

10.0 Related Policies, Procedures & Other Documents

Step 10: List any farm specific or industry specific documents that support or relate to this policy.

10.1 The **FARM's** Respiratory Protection Program and its parts:

a) List the parts here...

Approvals

Signature Here	*Signature Here*
First & Last Name Here	First & Last Name Here
Title/Position Here	Title/Position Here
Print Date Signed Here	*Print Date Signed Here*
Date Signed	Date Signed

Document Status

Version/Revision Number	Date	Reason

Appendix E: Respiratory Protection Program Overview

The information that follows represents a best practice, but should be modified to reflect the specific needs, factors, and conditions of the farm or ranch. Wherever possible, respirator users and other stakeholders should be involved in the development and implementation of the Respiratory Protection Program. At the end of each section, the appropriate clause in the CAN/CSA Standard Z94.4-18 S*election, use and care of respirators* is provided for your reference. If you are an employer, it is important to refer to current Alberta Occupational Health and Safety legislation.

1. Program Administration

a) Statement of purpose of the respiratory protection program.

b) Roles and responsibilities of the employer, the program administrator, respirator users, supervisors, respirator fit tester; it will also identify who is responsible for selecting the respirators, issuing the respirators, maintaining the respirators.

c) The role and responsibilities of a health care provider as it relates to this program.

d) Refer to CAN/CSA Standard Z94.4-18 *Selection, use and care of respirators*, Clause 4 *Respiratory protection program* and Clause 5 *Roles and responsibilities.*

2. Hazard Assessment

a) Addresses how hazards are identified and details what types of respiratory hazards are present.

b) Identifies the engineering and administrative hazard controls in place or to be used, as well as the type of respiratory protection.

c) Refer to CAN/CSA Standard Z94.4-18 S*election, use and care of respirators*, Clause 6 *Hazard and risk assessment.*

3. Respirator Selection

a) Details the criteria used to select a respirator, for example:
   - i) Hazard assessment review.
   - ii) Applicable legislation and standards.
   - iii) Work requirements and conditions.
   - iv) Worker health and ability to wear a respirator.
   - v) Characteristics and limitations of respirators.
   - vi) Respirator assigned protection factors.

b) Refer to CAN/CSA Standard Z94.4-18 S*election, use and care of respirators*, Clause 7 *Respirator selection.*

4. Training

a) Training details including any requirements for trainers, fit testers, respirator users, and supervisors.

b) Training should include instruction on:
   i) Policies, procedures, roles, and responsibilities.
   ii) Respiratory hazards within the work environment, the potential health and safety effects on the respirator user as well as how these hazards are controlled.
   iii) The reasoning behind the respirators selected and where to find more information about them.
   iv) Care, use, maintenance, and limitations of the respiratory protection devices.
   v) Procedures that will need to be followed in the event of an emergency.

c) Address training records, what should be kept and how.

d) Refer to CAN/CSA Standard Z94.4-18 S*election, use and care of respirators*, Clause 8 *Training*.

5. Respirator Fit Testing

a) Who should be fit tested and when fit testing should occur.

b) Identify the method(s) of fit testing, how it is to be conducted and what is considered a pass or fail.

c) Additional considerations when fit testing, such as:
   i) Facial hair
   ii) Personal conditions, effects and accessories
   iii) Other personal protective equipment

d) Refer to CAN/CSA Standard Z94.4-18 S*election, use and care of respirators*, Clause 9 *Respirator fit testing*.

6. Use of Respirators

a) Outlines user requirements, breakthrough detection and proper seal.

b) Addresses change-out procedures, schedules and service time of filters or cartridges.

c) Addresses service time of SCBA and breathing gas (if applicable).

d) Addresses communications and any special requirements (if applicable).

e) Refer to CAN/CSA Standard Z94.4-18 S*election, use and care of respirators*, Clause 10 *Use of respirators.*

7. Cleaning, Inspection, Maintenance and Storage of Respirators

a) Addresses inspection, cleaning, sanitizing, maintenance, and storage of respirators.

b) Provides a schedule of when inspection, cleaning, and sanitizing should occur.

c) Refer to CAN/CSA Standard Z94.4-18, *Selection, use and care of respirators,* Clause 10 *Use of respirators.*

8. Health Surveillance

a) Outlines the respirator user screening process.

b) Refer to CAN/CSA Standard Z94.4-18 S*election, use and care of respirators,* Clause 12 *Health surveillance.*

9. Program Evaluation

a) Identifies how often the program will be reviewed and by who.

b) Outlines the elements of the review, such as checking it against regulatory requirements, checking that procedures are being followed, etc.

c) Refer to CAN/CSA Standard Z94.4-18 S*election, use and care of respirators,* Clause 13 *Program evaluation.*

10. Recordkeeping

a) Identifies what records are to be maintained and for how long.

b) Refer to CAN/CSA Standard Z94.4-18 S*election, use and care of respirators,* Clause 14 *Recordkeeping.*

Appendix F: Respiratory Protective Equipment Screening Form Example

Disclaimer: This document is intended to be a resource document only. The farm may need to customize it and make it farm-specific to address the particular needs, factors, applicable legislated requirements, etc. A customizable version of this form can be downloaded from **agsafeab.ca**.

Date completed:

1.0 Employer Information *(please print)*
Farm Name:
Employer Telephone:
Employer Address:
Supervisor Name:

2.0 Respirator User Information *(please print)*	
First Name:	Last Name:
Position Title:	Telephone:

3.0 Jobs, Tasks, and/or Work Areas Requiring Respirator Use & Conditions of Use			
Expected level of physical exertion during use:	☐ Light	☐ Moderate	☐ Heavy
What will be the expected temperature during use:	☐ Colder than 0ºC	☐ 0 to 25°C	☐ More than 25°C
What is the atmospheric pressure during use?	☐ Lower than normal air pressure	☐ Normal air pressure	☐ Higher than normal air pressure
List other details as appropriate:			

4.0 Work Environment Considerations			
☐ Gases	☐ Vapours	☐ Dusts/fibres	☐ Mists
☐ Fumes	☐ Oxygen deficiency	☐ Biological contaminants	
List other details as appropriate:			

5.0 Personal Protective Equipment Worn While Wearing Respirators			
☐ Hard hat or bump cap	☐ Safety glasses	☐ Welding Mask	☐ Earmuffs
List other details as appropriate:			

6.0 Type(s) of Respirator(s) Used			
☐ Half-facepiece respirator	☐ Full-facepiece respirator	☐ Filtering facepiece respirator	☐ Loose-fitting respirator (hood or helmet)
☐ SCBA	☐ Supplied air respirator	☐ Air-purifying respirator	
List other details as appropriate:			

7.0 Respirator User's Health Condition

IMPORTANT: Check the yes or no box only. Do not specify any medical conditions on this form.

7.1 Do you have any of the conditions listed below? Please check ☐ YES or ☐ NO

Shortness of breath	Breathing difficulties	Chronic bronchitis	Emphysema
Lung disease	Chest pain or exertion	Hearth problems	Allergies
Hypertension	Cardiovascular disease	Thyroid problems	Diabetes
Neuromuscular disease	Fainting spells	Dizziness/nausea	Seizures
Fear of heights	Claustrophobia	Hearing impairment	Pacemaker
Panic attacks	Color blindness	Asthma	Vision impairment
Reduced sense of smell	Reduced sense of taste	Back/neck problems	Dentures
Diagnosed skin conditions		Unique facial features	
Other condition(s) affecting respirator use		Temperature susceptibility	

7.2 Have you had difficulty wearing a respirator before?
Please check ☐ YES or ☐ NO

7.3 Do you have any concerns about your future ability to use a respirator?
Please check ☐ YES or ☐ NO

7.4 Have you had an adverse health reaction while undergoing fit testing?
Please check ☐ YES or ☐ NO

7.5 If you have answered **YES** to 7.1, 7.2, 7.3, or 7.4, a further assessment by a health care professional is required prior to fit testing and respirator use.

Signature of Respirator User:	Date:
Signature of Supervisor:	Date:

8.0 Health Care Professional Primary Assessment *(complete this section if required, please print)*	
8.1	**Date of assessment:**
8.2	**Is fit testing and respirator use permitted?** Please check ☐ YES or ☐ NO
8.3	**The respirator user has been referred for further medical assessment:** Please check ☐ YES or ☐ NO
Comments:	
Name of Health Care Professional:	
Name of Clinic:	
Address of Clinic:	
Clinic Telephone:	
Signature of Supervisor:	Date:

9.0 Medical Assessment *(complete this section if required, please print)*
☐ **Class 1. No restrictions**
☐ **Class 2. Some specific restrictions apply:**
☐ **Class 3. Respirator use is NOT permitted.**
Comments:
Name of Physician:
Name of Clinic:
Address of Clinic:
Clinic Telephone:
Signature of Physician:

Appendix G: Fit Testing Form Example

Disclaimer: This document is intended to be a resource document only. The farm may need to customize it and make it farm-specific to address the particular needs, factors, applicable legislated requirements, etc. A customizable version of this form can be downloaded from **agsafeab.ca**.

Date completed:

1.0 Employer Information *(please print)*
Farm Name:
Employer Telephone:
Employer Address:
Fit Tester Name:

2.0 Respirator User Information *(please print)*	
First Name:	Last Name:
Position Title:	Telephone:
Respirator User's Direct Supervisor:	

3.0 Respirator Information		
Type of respirator (i.e., filtering facepiece respirator, half-facepiece respirator, etc.)		
Make of Respirator:	Model of Respirator:	Size of Respirator:

4.0 Fit Test		
Important: Any unsuccessful fit tests must be documented, including the nature/cause(s) for the failure.		
Pre-screening form completed and verified	☐ Pass	☐ Fail
Threshold screening	☐ Pass	☐ Fail
Respirator user put on the respirator properly without assistance	☐ Pass	☐ Fail
Negative pressure user seal check	☐ Pass	☐ Fail
Positive pressure user seal check	☐ Pass	☐ Fail
Respirator comfort assessment check (initial check)	☐ Pass	☐ Fail
Normal breathing exercise (30 seconds)	☐ Pass	☐ Fail
Deep breathing exercise (30 seconds)	☐ Pass	☐ Fail
Turning head from side to side exercise (30 seconds)	☐ Pass	☐ Fail
Nodding head up and down exercise (30 seconds)	☐ Pass	☐ Fail
Talking exercise (30 seconds)	☐ Pass	☐ Fail
Bending over exercise (30 seconds)	☐ Pass	☐ Fail
Normal breathing exercise (30 seconds)	☐ Pass	☐ Fail
Respirator comfort assessment check (secondary check)	☐ Pass	☐ Fail

5.0 Respirator Comfort Assessment
☐ 0 – No issue
☐ 1 – Minor discomfort that can be ignored
☐ 2 – Some discomfort, but still able to function
☐ 3 – Unacceptable discomfort, not bearable
A score of 2 may require the respirator to be removed, put back on, repositioned or an alternate respirator may be needed.
A score of 3 results in rejection of the respirator being worn and requires an alternative to be found.

6.0 Personal Protective Equipment Worn During Fit Testing
List all that apply (i.e., eye protection, face protection, etc.)

7.0 Particular Fitting Difficulties
This may include unique facial features that interfere with respirator fit.

8.0 Comments/Observations

9.0 Fit Test Method
Instrument make and model:
Serial number of test agent:

10.0 Signatures	
Signature of Respirator User:	Date:
Signature of Fit Tester:	Date:

Appendix H: Gas Monitors

GAS MONITOR BASICS

Gas Monitor

- A gas monitor, also called a gas detector or direct-reading instrumentation device, will contain one or more sensors to detect the presence of different types of gases.
- These are valuable tools for detecting and measuring gases, vapours, aerosols, and fine particulates suspended in air.
- Depending on the gas monitor used, they provide real-time or near real-time measurements.

Fixed Gas Monitors

- Fixed monitors are primarily used to protect a building, to detect catastrophic leaks, or to be an early warning of gases leaking from a system.
- These will only detect gas levels that diffuse into it, so if it is placed at one part of a room or building, it will not detect the levels at other points in the room or building.
    - For this reason, you cannot rely solely on fixed gas monitors; it is recommended to use fixed gas monitors in combination with personal gas monitors as appropriate.

Portable Gas Monitors

- Equipment used to test the air prior to entering an area that could have a hazardous atmosphere and may or may not be worn by a person.
- These will only detect gas levels that come into contact with the sensors.
- It will alarm when the alarm levels set on the equipment are reached.

Personal Gas Monitors

- A type of portable gas monitor.
- This type of gas monitor is a form of personal protective equipment because it is worn by people and is designed to protect them when going into and/or working in an area where hazardous gases or a hazardous atmosphere may exist or develop.
- These will only detect gas levels that come into contact with the sensors as the person moves around.
- These monitors will sound when gas levels reach a dangerous level.
- They can be used to sample gases before entering a work area.

Single-Gas Monitors

- Single-gas monitors detect only one hazardous gas at a time, such as nitrogen dioxide (NO_2) or ammonia (NH_3).

Multi-Gas Monitors

- Multi-gas monitors have more than one sensor and are able to detect a range of gases at the same time, such as oxygen (O_2), hydrogen sulfide (H_2S), carbon monoxide (CO), and the Lower Explosive Levels (LEL) of a variety of combustible gases.

Different Types of Gas Monitors

What a gas monitor detects, how it detects it, the environment it is designed to be used in, how it is used, how it is maintained and the cost of one can vary greatly. There are many types of gas monitors available, each of which is designed for a specific monitoring purpose.

It is not important that you understand how each one works, but it is important that you recognize there are differences between the types of gas monitors and how they work.

- Catalytic Bead Sensors
- Infrared (IR) Detectors
- Photoionization Detectors (PIDs)
- Electrochemical Sensors
- Metal Oxide Semiconductors (MOS)
- Ultrasonic Detectors
- Tunable Diode Laser Spectroscopy (TDLAS)
- Colorimetric Gas Detection Tubes
- Open Path Detectors
- Flame Ionization Detectors (FIDs)

Expiry or End-Of-Life?

Whether or not an instrument such as a detector or monitor expires or has an End-Of-Life will depend on that particular item. For example:

- A household carbon monoxide or smoke detector will typically have a sticker showing the date when the detector expires.
- A gas monitor may have a defined End-Of-Life, for example, this can be 24 months after its “turn on” date. This type of monitor may have a Remaining Life indicator which shows the remaining time left on the gas monitor before its End-Of-Life is reached (this may be displayed in months, days, or hours) and an End-Of-Life indicator. When the End-Of-Life indicator comes on, it is time to replace the gas monitor.
- Some gas monitors may not have a pre-defined life expectancy. One manufacturer states on its website that most medium to high end monitors can last between 5 to 10-plus years, depending on how well a monitor is maintained, how much it is used, and the environment that it is used in.

Calibration of Personal & Portable Gas Monitors

Calibrating your personal or portable gas monitor will ensure that it is accurately detecting gas levels. This is done by exposing the sensors to a known concentration of test gas (or calibration gas) for a specific amount of time. The reading from the test gas becomes the gas monitor's reference point for future readings. Important points to remember include:

- Using the wrong type of test gas or expired test gas can result in inaccurate readings (and have potentially fatal consequences). Always ensure that the correct test gas is used and that it has not expired.
- How responsive gas monitor sensors are may vary with the environmental conditions they will be used in. For this reason, it is best for personal or portable gas monitor users to perform calibrations in environmental conditions that are the same, or as close to, the actual conditions of the work environment as possible.
- Calibration will need to occur on a regular basis and in accordance with the manufacturer's guidelines; this is because calibration drift can occur, and other factors can affect how the personal or portable gas monitor functions. Always follow the manufacturer's guidelines for proper calibration of your specific personal or portable gas monitor.

Calibration Drift

Calibration drift is when a gas monitor's reference point shifts, and as a result the reading will shift and be unreliable. Calibration drift happens to all sensors over time, so calibration checks and full calibration will need to be performed.

While some of these factors may depend on the type of personal or portable gas monitor used, calibration drift commonly occurs because of:

- Exposure to certain chemicals or compounds in the work environment that may cause degradation of components or coat the sensors.
- Exposure to very high concentrations of target gases and vapours.
- Exposure to solvent vapours and highly corrosive gases.
- Exposure to very high concentrations of dusts and other airborne particles.
- Exposure to high humidity levels.
- Being splashed, soaked or dropped in water.
- Use in extreme temperatures (very hot or very cold temperatures).
- Rough use, handling or storage conditions (e.g., the gas monitor gets knocked around in a cab or dropped on the ground).
- The normal degradation of sensors and drift in electronic components that occurs over time.

If a personal or portable gas monitor is exposed to or suspected of being exposed to one of the conditions noted above, the user should verify the personal gas monitor's function by performing a calibration. If the personal gas monitor is not successfully calibrated (e.g., there is a failure message), refer to the manufacturer's instructions for servicing and sensor replacement.

Calibration Check

A calibration check verifies that the sensor(s) and alarms on a personal gas monitor respond within the manufacturer's acceptable limits by exposing it to a test gas. During a calibration check, the user will compare the test gas concentration to the reading on the personal gas monitor. If the results are found to be within the manufacturer's acceptable limits, the calibration check has verified the gas monitor's accuracy.

If the calibration check results are not found to be within the manufacturer's acceptable limits, a full calibration will need to be performed.

Full Calibration

A full calibration is a process that adjusts a personal or portable gas monitor's reading to coincide with the known concentrations of zero and span gases. This results in two steps:

1. **Zero calibration,** sometimes called zero suppression, is where the personal gas monitor is exposed to the ambient or "zero grade" air. Each sensor registers to zero and the O_2 sensor is calibrated to a value of 20.9%.
2. **Span calibration** is where each sensor expects to be exposed to a known concentration of gas. As each sensor calibrates, the personal gas monitor adjusts to the calibration gas and known values if needed to ensure that the gas concentration values are accurately registered and displayed.

It is important to note that if a sensor has degraded beyond an acceptable level, it will have reached its End-Of-Life and will no longer pass a calibration. Any servicing that is performed, such as the replacement of sensors, must be performed as per the manufacturer's instructions and by a qualified person.

General Calibration Rules

The U.S. Department of Labor Occupational Safety and Health Administration (OSHA) outlines the following basic calibration rules for personal and portable gas monitors:

1. Follow the manufacturer's guidelines for proper calibration
    a) The correct type and concentration of calibration test gas, sample tubing, flow regulators, and calibration adapters are essential for proper calibration.
    b) Personal gas monitor users should conduct testing to verify the operation of the gas monitor in an environment that is the same as (or similar to) the working conditions.

2. Only use a certified, unexpired traceable test gas.
    a) The personal gas monitor will only be as accurate as the test gas used to calibrate it.
    b) Ensure the supplier can provide a certificate of analysis for every test gas cylinder.
    c) The concentration of the test gas, particularly reactive gases such as hydrogen sulfide and chlorine, will only remain stable for a limited period of time.
    d) Never use a test gas after its expiration date.
3. Train personal or portable gas monitor users on the proper calibration methods.
    a) Most personal or portable gas monitors are designed to be field calibrated with detailed instructions provided in the manufacturer's user manual, training videos, or computer-based training modules.
    b) Employers must ensure everyone responsible for using, handling and calibrating personal or portable gas monitors is trained and competent.

(Occupational Safety and Health Administration, 2013)

DID YOU KNOW?

- Bump tests should be performed before every use.
- A bump test verifies performance; it does not provide a measure of the gas monitor's accuracy.

BUMP TESTS

A bump test, also called a function check, verifies that:

- Gas can get to the personal gas monitors sensor(s).
- Each sensor responds to its target gas.
- The personal gas monitor's alarms are working.

A bump test involves using what is called a challenge gas (a single or mixed gas blend depending on the gas monitor). The sensor(s) are exposed to the challenge gas at a concentration and for an amount of time that will activate all of the alarm settings. If a personal gas monitor fails a bump test, do not use it! It should immediately be taken out of service and given to someone qualified to complete inspection and recalibration.

Bump tests should be performed as per the manufacturer's instructions. As things can go wrong and personal gas monitors can be affected by rough handling, vibration, drops, moisture, extreme temperatures, contamination, mechanical failures, etc., a bump test should be performed before every use.

Bump tests are typically thought of as a type of field test, meaning that they are performed in a clean area at the location where the gas monitor will be used. Bump tests ensure that the gas monitor is working properly and has not been damaged during transport.

Choosing a Personal or Portable Gas Monitor

Choosing the right gas monitor can be challenging. Some considerations to factor in are:

- **How accurate is the gas monitor?** The more accurate the readings, the safer the person using it will be.
- **Does it detect the gas(es) you need it to?** Refer back to your hazard assessment(s) for the gases that you will need to be monitoring and/or testing for. If explosive gases may be present in the work area, the gas monitor will need to be extrinsically safe.
- **What is the response time?** Faster response times allow the person using it to act quickly.
- **Does it have protection from things like radio frequency interference, dust and water?**
- **Does it have data logging capabilities that will support recordkeeping?**
- **What are the alarms like?** Is it easy to distinguish a warning alarm from a danger alarm? Will the alarm be immediately recognized when it goes off in the work environment?
- **How resistant is it to being dropped or exposed to harsh environments?** Is it impact resistant? How well will it handle corrosive gases like ammonia in a barn? What is the temperature range it works in? What is the humidity range it works in?

- **How user-friendly is it?** The easier it is to use, the better. Read the Manufacturer's User Manual, watch any videos relating to its use, care & maintenance that are available, and if possible, take any online or in-person training offered by the manufacturer relating to its use.
  - Is it easy to operate?
  - Is the display easy to read?
  - Will it be easy to use if the person using it is wearing gloves?
  - How big and bulky is it? Is it overly large or heavy?

Questions to Ask the Supplier or Manufacturer

Additional questions to ask the supplier or manufacturer include:

- **What does the total cost of ownership look like?**
- **Does it meet the current CSA Group standard and any other applicable standards?**
- **What is the cost and availability of replacement sensors, test gas, challenge gas, and other items that you may need (i.e., testing stations)?**
- **What are the personal gas monitor's servicing requirements, and does it have a warranty?** If it needs to be sent away for warranty work, repairs or maintenance, where is the repair and maintenance facility (e.g., can it be arranged through the supplier, is it sent somewhere in Canada or does it have to be sent somewhere internationally)?
  - What are the warranty details, for example, is the warranty tied to the manufacture date and does the shelf-life affect the warranty (e.g., does the warranty cover one year of shelf life and one or more years after activation)?

Glossary

Acute: Of sudden onset, lasting a short time or requiring short-term medical care.

Act: A form of law that allows a government to regulate an area, such as Occupational Health and Safety (Government of Canada, 2011).

Administrative control: These controls change the way people work and involve developing a method or standard way of doing things that minimizes the hazard.

Adsorbent: A material capable of collecting molecules of gases or solutions that they come not contact with on their external or internal surface.

Airborne: Something that is suspended in or carried by the air.

Airline supplied-air respirator: A type of respirator that is connected to a separate source of air and provides clean air through a hose called an airline.

Air-purifying Respirators (APRs): A type of respirator that removes contaminants from the air being breathed in by filtering out particulates and/or absorbing gases or vapours.

Assigned Protection Factor (APF): The expected level of respiratory protection that would be provided by a properly fitted and functioning respirator being used by a competent person.

Atmospheric hazard: A hazard found in the in the atmosphere that could cause damage to someone or something.

Audit: An audit is an evaluation of an operations health and safety program or a part of it (e.g., respiratory protection program) against an approved standard.

Best practice: An agreed-upon method for conducting a specified task that is usually established by industries, trades or groups of peers.

Biological contaminant: Bacteria, moulds, mould spores, pollens, viruses, and other biological materials that are polluting or poisonous in some way.

Breakthrough exposure: Also called breakthrough, occurs when a chemical cartridge becomes wet or saturated and the gases or vapours leak through the cartridge and can be breathed in by the respirator user.

Canister: Refer also to the definition of Cartridge. A type of cartridge that holds a higher volume of sorbent material and may be used in areas with higher concentrations of gases and vapours than a typical cartridge.

Cartridge: 1. Sometimes used interchangeably with the term canister, this type of respirator filter removes gases, volatile organic compounds (VOCs) and other vapours from the air being inhaled by a respirator user. 2. A “container with a filter, sorbent, or catalyst, or combination of these items, which removes specific contaminants from the air passed through the container (Occupational Safety and Health Administration, 2009, p.8).”

Chemical cartridge respirators: See also the term Gas mask. A type of air-purifying respirator that filters or cleans chemical gases and possibly particles out of the air that is breathed in (National Institute for Occupational Safety and Health, 2020). May also be equipped with a particulate filter.

Clean shaven: Generally means having shaved within 12 hours of the work shift, but no more than 24 hours.

Codes: Codes are pieces of legislation that can be enforced.

Code of practice: A written guideline that provides detailed information on a subject and is used to help ensure that legislative, ethical and health standards are met.

Combination respirators: Refer to the term *Multi-functional respirators.*

Comfort: In terms of respirator comfort, respirator use is expected to cause a degree of discomfort. Being comfortable with while wearing a respirator should be thought of as feeling reasonably physically at ease and without irritation, aching or pain.

Competent person: A person who is adequately qualified, suitably trained, has the necessary attitude, and has enough experience to safely perform work without or with only a minimal degree of supervision (Occupational Health and Safety Act, 2022, s.1(d)).

Compressed breathing air: Normal air that is processed by a compressed breathing air system and meets the purity requirements CSA Z180.1 Compressed breathing air and systems.

Concentration: The amount of a substance in a defined space.

Confidential records: Types of documentation (e.g., written, electronic, photograph, etc that contain private information, such as medical information, birthdates, home addresses, etc. that need to be stored in a way that is secure and can only be accessed by authorized individuals for work related reasons.

Confined space: "A restricted space which may become hazardous to a worker entering it because of (a) an atmosphere that is or may be injurious by reason of oxygen deficiency or enrichment, flammability, explosivity or toxicity, (b) a condition or changing set of circumstances within the space that presents a potential for injury or illness, or (c) the potential or inherent characteristics of an activity which can produce adverse or harmful consequences within the space (Occupational Health and Safety Code, Statutes of Alberta 2021, s.1)."

Contaminant: Any physical, chemical, biological or radiological substance or matter that may be harmful to humans or other living organisms, such as a gas, vapour, liquid, or solid material that is not normally found in the air or is normally found only in small, acceptable amounts. These materials have known toxic properties or other negative health effects.

Continuous-flow supplied-air respirator: A type of positive pressure respirator that maintains constant airflow into the facepiece.

Decontaminate: To remove or neutralize a harmful, irritating or nuisance material that has built up on something or someone.

Demand respirator: A negative pressure respirator; a respirator that will have negative pressure in the facepiece during inhalation.

Demonstration of competency: A written or demonstrated understanding of the required knowledge, skills, practices and procedures.

Due diligence: The level of judgment, care, caution, purpose, and activity that a person would reasonably be expected to do under specific circumstances; it can only be shown by actions taken before an event occurs.

Duration: The time during which something occurs.

Dust: Small solid fragments or tiny pieces of something that may or may not be visible to the naked eye.

Elastomeric: Rubber-like; it is a natural or synthetic material that has elastic properties.

Elimination: Where the hazard is removed from the job, task or work environment.

End-of-service-life indicator (ESLI): A device that is designed for use with contaminants with poor warning signs. These devices change color to show when a cartridge has been used up, is no longer effective, and needs to be changed.

Escape cylinder: 1. A self-contained breathing air supply that is used for emergency escape from an IDLH atmosphere. 2. A small secondary air cylinder that is used when the supplied-air fails or if the respirator user must disconnect from the supplied-air for any reason.

Escape-only respirator: A respirator designed to be used to escape from a hazardous atmosphere only.

Engineering control: Methods to isolate or separate workers from the hazard or to remove the hazard at the source before a worker can come into contact with it.

Exposure: To be exposed to, and not protected from, something.

Face mask: A loose-fitting mask that covers the nose and mouth and are worn to help prevent large droplets from being spread.

Facepiece: The part of the respirator that covers the nose and mouth of the respirator user.

Fibre: A small solid fragment or tiny piece of something with a threadlike or elongated shape that may or may not be visible to the naked eye.

Filter: A “component used in respirators to remove solid or liquid aerosols from the inspired air (Occupational Safety and Health Administration, 2009, p.8). “

Filter media: The material that separates unwanted particles from what is being filtered, such as the air being breathed in.

Fit factor: "A quantitative estimate of the fit of a particular respirator to a specific individual, and typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn (Occupational Safety and Health Administration, 2009, p.8)."

Fit test: The use of a qualitative or quantitative measure to assess the fit of a particular make, model, and size of respirator on a respirator user.

Force fitting: When a failed fit test is repeated using the same respirator. In force fitting, the respirator continues to be put back on or have other adjustments made to it, such as overtightening of the straps, until a fit test pass is achieved.

Fume: Very fine, solid particles that are suspended in air, such as in smoke, vapour or gas.

Gas: A gas is substances that do not exist as a solid or liquid at room temperature.

Gas mask: 1. A type of air-purifying respirator that filters or cleans chemical gases and possibly particles out of the air that is breathed in (National Institute for Occupational Safety and Health, 2020). 2. A type of air-purifying, chemical cartridge (or canister) respirator that contains more adsorbent than a cartridge-type respirator and can provide a higher level of protection as result of this.

Hazard: Something that could cause damage or harm to someone or something on your farm.

Hazard control: An action or actions taken to eliminate or minimize the risk of injury, illness or damage.

Hazard elimination: Removing a hazard from the workplace. The most effective and reliable means of addressing a hazard; should be used whenever possible.

Hazardous atmosphere: An atmosphere, such as the air in a work area, which may expose someone to the risk of death, incapacitation, impairment, injury or acute illness as a result of it being or becoming in some way dangerous to life or health (e.g., flammable, combustible, explosive, toxic, or oxygen deficient).

Hierarchy of controls: A system for controlling risks in the workplace where risk controls are ranked from the highest level of protection and reliability through to the lowest and least reliable level of protection.

High efficiency (HE) filter: Refer to the definition of High efficiency particulate air (HEPA) filter.

High efficiency particulate air (HEPA) filter: 1. A type of mechanical air filter that can remove at least 99.97% of airborne particles with a size of 0.3 microns. 2. "A filter that is at least 99.97% efficient in removing monodisperse particles of 0.3 micrometers in diameter. The equivalent NIOSH 42 CFR 84 particulate filters are the N100, R100, and P100 filters (Occupational Safety and Health Administration, 2009)."

Hypoxia: The term used when there is not enough oxygen reaching the tissues in someone's body (low blood oxygen).

Immediately dangerous to life or health atmosphere (IDLH): 1. “An atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual’s ability to escape from a dangerous atmosphere (Occupational Safety and Health Administration, 2009, p.8)." 2. “Circumstances in which the atmosphere is deficient in oxygen or the concentration of a harmful substance in the atmosphere (a) is an immediate threat to life, (b) may affect health irreversibly, (c) may have future adverse effects on health, or (d) may interfere with a worker’s ability to escape from a dangerous atmosphere (Occupational Health and Safety Code, Statutes of Alberta 2021, s.1).”

Inspection: The act of carefully and critically examining something to ensure it is free from weaknesses or limitations.

Inspired: Air that is breathed in.

Intrinsically safe: Tools or equipment that have been certified as not being a source of ignition.

Make: This is respirator manufacturer or the respirator manufacturer’s brand name.

Mediastinum: A space in the chest between the lungs that contains the heart.

Micron: Short for micrometer, a unit of measure. Used to measure the size of very small things, such as the size of a contaminate particle.

Mist: Tiny droplets suspended in air that are produced by scattering or distributing a liquid over an area or by condensation (when a vapour or gas changes into a liquid form).

Model: This is the respirator’s design, that is part of the manufacturer’s range or series of respirator.

Monodisperse: Particles that are the same size that have been distributed or spread over a wide area.

Multi-functional respirator: Sometimes called a combination respirator, this is a type of respirator that can operate as either an air-purifying or an atmosphere-supplying respirator.

National Institute for Occupational Safety and Health (NIOSH): The United States federal research agency focused on researching worker health and safety and making recommendations for the prevention of workplace injury and illness.

Negative pressure respirator: A tight-fitting respirator where the air pressure in the facepiece is negative in relation to the air pressure outside of the respirator during inhalation.

Oil: A liquid made up of organic molecules.

Oil proof: Does not allow oil to pass through it or is not affected by oil.

One shift: A term that means eight hours of continuous or intermittent use (Canadian Centre for Occupational Health and Safety, 2024).

Oxygen deficient environment: An environment or workspace with air that contains less than 19.5% oxygen.

Particulate: Very small, separate pieces of matter in either a liquid or solid state. Dusts, fumes, mists (droplets), fibres, fog, pollen, smoke, spores, and bioaerosols are all forms of particulate.

Particulate filter: A filter designed to remove solid particles from the air being inhaled by a respirator user

Particulate respirators: A type of air-purifying respirator that filters out particles only, such as dusts fumes and mists.

Permeable: A material that allows liquids or gases to enter or pass through it.

Personal protective equipment (PPE): Anything worn by someone to reduce their exposure to a hazard.

Positive pressure: "Refers to pressure-demand mode or continuous-flow mode respirators (Alberta Government, 2020, p.4)". "A respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator (OSHA, 2009, p.8)."

Powered air-purifying respirators (PAPRs): A type of respirator that uses a battery powered blower to draw air through the filter or cartridge.

Pressure-demand supplied-air respirator: A type of positive pressure respirator that provides air to the wearer based on their breathing; it keeps the pressure inside the facepiece positive during use (during both inhalation and exhalation).

Program administrator: The person designated by the farm to manage and direct the respiratory protection program.

Qualitative fit test (QLFT): A pass or fail respirator fit test method that relies on the respirator user's ability to sense a test agent; this is performed order to assess if an adequate respirator fit has been achieved.

Quantitative fit test (QNFT): A respirator fit test method using specialized equipment to measure the amount of test agent leaking into the facepiece of a respirator. The concentration of test agent outside the facepiece is compared to the concentration of test agent inside the facepiece and is used determine the level of protection provided by the respirator.

Reasonably practicable: 1. Meeting a legislated occupational health and safety obligation in a way that is sensible, realistic and would be thought of as making sense for the facts and conditions by a reasonable person. 2. A recognized term that is based on the reasonable person test, which basically asks, what would a dozen of your peers consider reasonable in similar circumstances (Government of Alberta, 2017, p.1)?

Rebreather: Refer to the term *Self-contained breathing apparatus (SCBA) – Closed Circuit*.

Records: A form of evidence that provides information about the farm's activities, what it has done and even what it plans to do. Records can include paper documents, digital records, emails, photographs, etc.

Recordkeeping: The management of records, such as what documents are created, where they are stored, how they are used, who can access them, and finally when and how they are disposed of.

Regulations: Regulations commonly list the requirements for specific workplace conditions and work practices in more detail than an Act. Regulations can be sector specific (as we have seen with farming and ranching) or hazard specific.

Respiratory protection program: Farm specific written procedures and policies that together enhance employee health, promote the effective use of respiratory protective equipment, and make it easier to meet legislative, ethical and health standards.

Responsibilities: The tasks or duties that people in the various positions are expected to complete as a function or part of their job.

Respirator: A type of personal protective equipment worn by the respirator user that protects them from breathing in airborne contaminants and/or inhaling a hazardous atmosphere.

Respiratory hazard: Airborne substances or particulates that when breathed in can damage the respiratory tract, cause illness or disease, and even result in death.

Respiratory system: Also called respiratory tract. In humans, it is the system of organs responsible for respiration and consists of the nose, nasal passages, pharynx, larynx, trachea, bronchi, and lungs.

Restricted space: A work area that is not meant to have someone in it all of the time or even very often, would be big enough to enter and difficult to get in or out of, and would not have any other hazards or have the hazards properly controlled (Occupational Health and Safety Code, Statutes of Alberta 2021, s.1).

Role: The position or purposes that someone has in a situation or organization; the position held by someone on the farm.

Screening: Evaluating something or someone to assess ability or suitability, such as screening someone to ensure that it is safe for them to wear a respirator.

Self-Contained Breathing Apparatus (SCBA): A respirator that has a portable supply of breathing air which is separate from the surrounding atmosphere (work environment).

Self-contained breathing apparatus (SCBA)—closed circuit: A respirator that has a portable supply of compressed breathing air which is separate from the air in the work environment; the exhaled air is 'rebreathed' by the respirator user after it has recirculated in the system (where the carbon dioxide is removed, and the oxygen concentration restored to acceptable levels).

Self-contained breathing apparatus (SCBA)—open circuit: A respirator that has a portable supply of compressed breathing air which is separate from the air in the work environment; the exhaled air is not recirculated in the system, but rather passes out of the respirator into the work environment.

Service life: The acceptable period of use in service or the expected lifetime of the respiratory protective equipment where it will provide adequate protection to the respirator user.

Single-use: Designed to be used only once and then disposed of properly.

Substitution: Where a hazard or the source of the hazard is replaced with something less harmful.

Supplied-air respirators (SARs): A type of respirator that provides clean air from an uncontaminated source.

Surgical mask: A type of face mask that covers the nose and mouth of the wearer to help prevent large droplets from being spread.

Standard: A voluntary way of doing something that has been agreed upon by a company itself, by an industry, or by a recognized organization such as the CSA Group.

Test Agent: A substance with irritant, odour or taste properties used to check the seal on a tight sealing respirator when performing a qualitative fit test; this type of testing relies on the respirator user's ability to detect the testing agent.

Toxic: Poisonous or harmful.

Toxicity: The property of a substance being harmful to a living thing and the level of harm it can cause.

Training: An act or process where skill, knowledge and experience are provided to a worker with respect to a particular subject matter and which requires a practical demonstration by the worker to support that they have acquired the knowledge or skill they have been learning.

User seal check: "An action conducted by the respirator user to determine if the respirator is properly seated to the face (Occupational Safety and Health Administration, 2009, p.11)."

Vapour: The gaseous form of a substance that is normally a liquid or a solid at room temperature.

Volunteer: Someone who performs or provide services without being paid and have the same health and safety rights and responsibilities as any other workers under Alberta OHS legislation; a volunteer is still a worker, but they are not considered to be a regularly employed worker (Government of Alberta, 2022, p.1).

Ventilation: A means of moving fresh air into an area or removing contaminated or stale air from an area.

Warning properties: These are properties that tell the respirator user when a cartridge is no longer working. Different contaminants have different warning properties, such as an odour, a taste or a feeling of irritation in the respiratory tract (nose, throat, larynx, trachea, bronchi and lungs).

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