

PPE: How to Choose Appropriate Respiratory Protection for Workers



Employers have a duty to protect workers from respiratory hazards, such as dust, smoke, fumes, etc. But different kinds of respiratory hazards require different kinds of respiratory protection. Chose the wrong type of respirator and workers won't be adequately protected from these hazards and could develop serious health problems and even die. Choosing the right respirator will adequately protect workers—and keep your company from getting fined for an OHS violation. Here are the steps you should take to ensure that workers get the proper respiratory protection.

MODEL TOOL: Download a Respiratory Protection Selection Form you can use to document the information you gather during your hazard assessment and the reasons particular respiratory protection was selected.

Defining Our Terms

This article deals with general respiratory protection requirements rather than specific requirements that apply to certain hazards, such as confined spaces, or jobs, such as firefighting It also doesn't address the selection of so-called "escape" respirators.

WHAT THE LAW SAYS

In short, except for ON and SK, every jurisdiction's OHS laws adopt Canadian Standard Association (CSA) standard CSA Z94.4, *Selection, Use and Care of Respirators* and most require employers to comply with this standard when selecting respiratory protection for workers. In the jurisdictions that have adopted CSA Z94.4 into their OHS law, the standard is no longer a voluntary standard and thus you must comply with it. And even in the two jurisdictions that haven't adopted this standard, it likely still represents a best practice.

So you should generally follow CSA Z94.4 when selecting appropriate respiratory protection for your workers. But you should also be familiar with your jurisdiction's OHS regulations because they may include additional requirements or requirements for specific situations or types of respirators.

HOW TO COMPLY

Here are the steps you should take to choose appropriate respiratory protection for your workers. This process should generally involve the safety coordinator as well as appropriate supervisors, the JHSC and the workers exposed to the respiratory hazards. Ideally, your company should have a respiratory protection program. If it does, include these steps in that program. If not, include them in a separate policy or procedure on respiratory protection selection.

Step #1: Conduct a Respiratory Hazard Assessment

As noted above, different kinds of respiratory hazards require different kinds of respiratory protection. (See below for basic types of respirators.) For example, oxygen deficiency must be handled differently than exposure to an airborne contaminant and different airborne contaminants require different kinds of protection. Even the same airborne contaminant may require different types of respiratory protection depending on its level or concentration.

So you should first conduct an assessment to determine the kinds of respiratory hazards that exist in the workplace or with regards to a particular job. Conducting an assessment of respiratory hazards is very technical and requires the use of special equipment and careful calculations. So it's critical that the assessment be performed by a competent person who's trained and qualified to carry out the necessary tests and understands the testing equipment, its uses and limitations. The respiratory hazards assessment should cover the following:

Oxygen levels. Remember that contaminants in the air aren't the only respiratory hazards to which workers can be exposed. Insufficient or too much oxygen is another respiratory hazard that could endanger workers. So calculate the oxygen levels in the work area and consult your jurisdiction's OHS regulations for the levels deemed to be safe for workers.

Presence of airborne contaminants. To adequately protect workers, you need to know exactly what airborne contaminants to which they could be exposed. When identifying the contaminants present in the workplace, consider the following factors:

- The characteristics of operations or processes as they relate to the release of air contaminants through routine procedures, non-routine procedures, malfunctions or spills;
- The length of time a worker would have to wear a respirator and the physical demands on that worker;
- Characteristics of the work area, including layout, work activities, temperature, humidity, atmospheric pressure, escape routes and maintenance procedures;
- Materials used, produced or stored in the work area, including raw materials, end products, by-products, chemical reactivity and wastes; and
- Emergency factors, including repairs, shutdown procedures, escape and rescue operations.

You also need to determine the physical state of the identified contaminants present, such as gas, dust, vapour, particulate, etc..

Concentration of the contaminants. Although the mere presence of certain airborne contaminants is enough to require respiratory protection, for many contaminants, their concentration is what determines whether respiratory protection is required or the type of protection that must be used. So you also

need to know the concentrations of all identified contaminants. You can determine the concentrations through:

- Air sampling and analysis conducted in accordance with accepted protocols;
- Mathematical modelling or estimating based on the workplace volume and physical properties, such as vapour pressure; or
- Experience from other similar circumstances and materials.

When estimating the concentrations, take into account variations in operations, rate and direction of air movement, temperature (ambient or process) and seasonal variations.

OELs for contaminants. Most jurisdictions have occupational exposure limits (OELs) for certain substances that limit the length of time workers can be exposed to them. The OHS laws often adopt the OELs set by the American Conference of Governmental Industrial Hygienists (ACGIH). So for each identified airborne contaminant, check your jurisdiction's OHS law to see if there's an OEL for that contaminant and, if so, what that OEL is.

Presence of an IDLH atmosphere. You also need to determine whether the atmosphere is immediately dangerous to life or health (IDLH)—that is, it poses an immediate threat to life, would cause irreversible adverse health effects or would impair an individual's ability to escape. For example, an oxygen deficient atmosphere is IDLH. An IDLH atmosphere is assumed in certain circumstances, including an untested confined space and areas in which;

- A known hazardous contaminant is present at or above published IDLH levels;
- A known hazardous contaminant is present at an unknown concentration;
- A low oxygen concentration may produce a level of hypoxia that is IDLH; or
- The conditions present, in the opinion of a qualified person, a potential IDLH atmosphere.

Standards or regulations that apply to contaminants. Certain contaminants, such as asbestos, may be subject to specific requirements, standards or regulations. So check to see whether any special requirements apply to any of the airborne contaminants you've identified.

Contaminants' warning properties. Some contaminants have warning properties, such as an odour, taste or irritation, that alerts you to their presence at certain concentrations or levels. For example, cyanide can smell like bitter almonds. So determine the warning properties, if any, of the identified airborne contaminants.

Eye and skin hazards. Obviously, we've focused on respiratory hazards to this point. But some airborne contaminants pose not only respiratory but also eye or skin hazards at certain levels or concentrations. And you need to know this information. For example, a substance may make a worker's eyes itch if he's exposed to it. In that case, you'd want to consider a full-face respirator as opposed to a half-faced one that leaves the worker's eyes exposed and thus vulnerable to the contaminant.

The person who performs the assessment should put the results in writing and sign it.

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document the information you gather in your hazard assessment and the reasons particular respiratory protection was selected.

Step #2: Choose Appropriate Respirator

Use the information gathered in the respiratory hazard assessment to determine which kind of respirators would be appropriate for workers exposed to the identified hazards. Because selecting appropriate respirator protection is complicated, CSA Z94.4 recommends use of a respirator selection flowchart. The standard has a very detailed flowchart you can use. Here is a basic respirator flowchart that walks you through the general process of selecting appropriate respiratory protection.

Based on CSA Z94.4 (2002 version), answer the following questions to select an appropriate respirator:

Does the OHS law require a specific respirator for the identified hazards? If your jurisdiction's OHS law requires the use of a particular type of respirator for specific hazards or conditions and your assessment identified those hazards or conditions, you must select the respirator required by law.

Does the hazard involve abrasive blasting? If so, select a supplied-air type CE respirator or an alternative respirator approved for use during abrasive blasting.

Is the atmosphere IDLH because of an oxygen deficiency? If so and oxygen deficiency is the only respiratory hazard, select a demand closed-circuit self-contained breathing apparatus (SCBA).

Is the atmosphere IDLH but oxygen deficiency isn't the only respiratory hazard? If so, select a pressure-demand SCBA or a combined pressure-demand supplied-air respirator with auxiliary self-contained air supply.

Is the oxygen concentration low but not IDLH? If the oxygen concentration is less than 19.5% at sea level or equivalent and there's no other respiratory hazard, then select any supplied-air respirator.

Are there OELs for the identified respiratory hazards? If not, use professional judgment to select the appropriate respiratory protection. If you don't have enough information to do so, select a pressure-demand SCBA or combined pressure-demand supplied-air respirator with auxiliary self-contained air supply.

If there are OELs for the identified contaminants, for each one, calculate the "hazard ratio" (HR) by dividing the contaminant's airborne concentration by its OEL. Once you have HRs for each contaminant, select the highest HR (HHR) and use that ratio for the rest of the selection process.

Is there a low oxygen concentration *and* other respiratory hazards? If so, choose and appropriate supplied-air respirator based on the HHR:

- 10 or less: half-facepiece demand supplied-air respirator;
- 25 or less: loose-fitting facepiece/visor supplied-air respirator;
- 50 or less: pressure-demand half-facepiece supplied-air respirator;
- 100 or less: demand full-facepiece supplied-air respirator or demand SCBA;
- 1,000 or less: continuous-flow or pressure-demand full-facepiece supplied-

- air respirator or a helmet/hood continuous-flow supplied air option; and
- Greater than 1,000: pressure-demand SCBA or combined pressure-demand supplied-air respirator with auxiliary self-contained air supply.

Is there no oxygen deficiency hazard? If the only respiratory hazards involve the presence of contaminants and not oxygen deficiency, you can choose either a supplied-air respirator based on the HHR using the above guidelines or an air-purifying option based on the following HHR guidelines:

- Five or less: quarter facepiece;
- 10 or less: half-facepiece;
- 25 or less: loose-fitting facepiece/visor powered air-purifying respirator (PAPR);
- 50 or less: half-facepiece PAPR;
- 100 or less: full facepiece;
- 1,000 or less: full facepiece or helmet/hood PAPR; and
- Greater than 1,000: because an air-purifying respirator isn't suitable for an HHR at this level, select a pressure-demand SCBA or a combined pressure-demand supplied-air respirator with auxiliary self-contained air supply.

Is the contaminant in the form of a gas or vapour? If so and there's no gas and/or vapour purifying element available, an air-purifying respirator isn't appropriate. Select a supplied-air respirator based on the HHR as discussed previously. If a gas and/or vapour purifying element *is* available, choose the appropriate one

Is there a particulate hazard? If so and you've narrowed your choices to a PAPR style respirator to this point, choose an He class filter. Otherwise, the filter choice will depend on whether airborne oil is present. If it is, select any R or P particulate filter. If not, select any N, R or P particulate filter. And if there's a particulate hazard and you've narrowed your choices to a supplied-air respirator, choose the type of such respirator based on the HHR as discussed previously.

Is the respiratory hazard also an eye irritant? If the identified contaminants are both respiratory and eye hazards and you've narrowed your choices to a quarter or half-facepiece respirator, choose an alternative facepiece with eye protection instead.

Once you've selected the type of respirator that's appropriate for the hazards, you'll need to choose a particular brand or model. Note that most jurisdictions require employers to select only respirators that have been approved for use in the workplace. For example, federal OHS regulations require employers to provide workers with respiratory protective devices that are on the NIOSH Certified Equipment List. You should also review the manufacturer's specifications for the chosen respirator to ensure that it's suitable for your intended use.

Step #3: Ensure Chosen Respirator Is Appropriate for Worker

The respirator you've selected may be appropriate for the respiratory hazards but it must also be appropriate for the worker who'll use it. For example, a respirator won't protect a worker if he has a health condition that impacts his ability to wear a respirator or use a specific type of respirator. So do two things to ensure a worker can safely use the chosen respirator:

Conduct a health assessment. Before workers use the respirators you've selected, make sure that they don't have any medical conditions (physical or

psychological) that could affect their use of this equipment. For example, breathing through a respirator with a filter takes more effort than normal breathing. So a worker with asthma or a lung condition may have problems using such a respirator and thus it wouldn't be appropriate for him.

Conduct a fit test. The respiratory protection you've selected for a worker is only appropriate if it fits him properly. So before a worker uses the respirator you've selected for him, conduct a fit test. Make sure to document that you've done so and the results of the fit test.

BOTTOM LINE

Choosing the right kind of respirator can literally mean the difference between life and death for workers exposed to respiratory hazards. So it's critical that you have a process in place to ensure that appropriate respiratory protection is selected for workers based on the hazards to which they'll be exposed.

Basic Types of Respiratory Protection

There are two broad types of respiratory protection:

Air-purifying respirators. This type of respirator removes contaminants in the air that the worker breathes by filtering out particulates, such as dusts, metal fumes or mists, or adsorbing gases or vapours. Examples of air-purifying respirators:

- Particulate respirators;
- Chemical cartridge respirators;
- Gas masks; and
- Powered air-purifying respirators (PAPRs).

Supplied-air respirators. This type of respirator supplies clean air. They don't filter or clean the air. They are also called atmosphere-supplying respirators. There are three basic types:

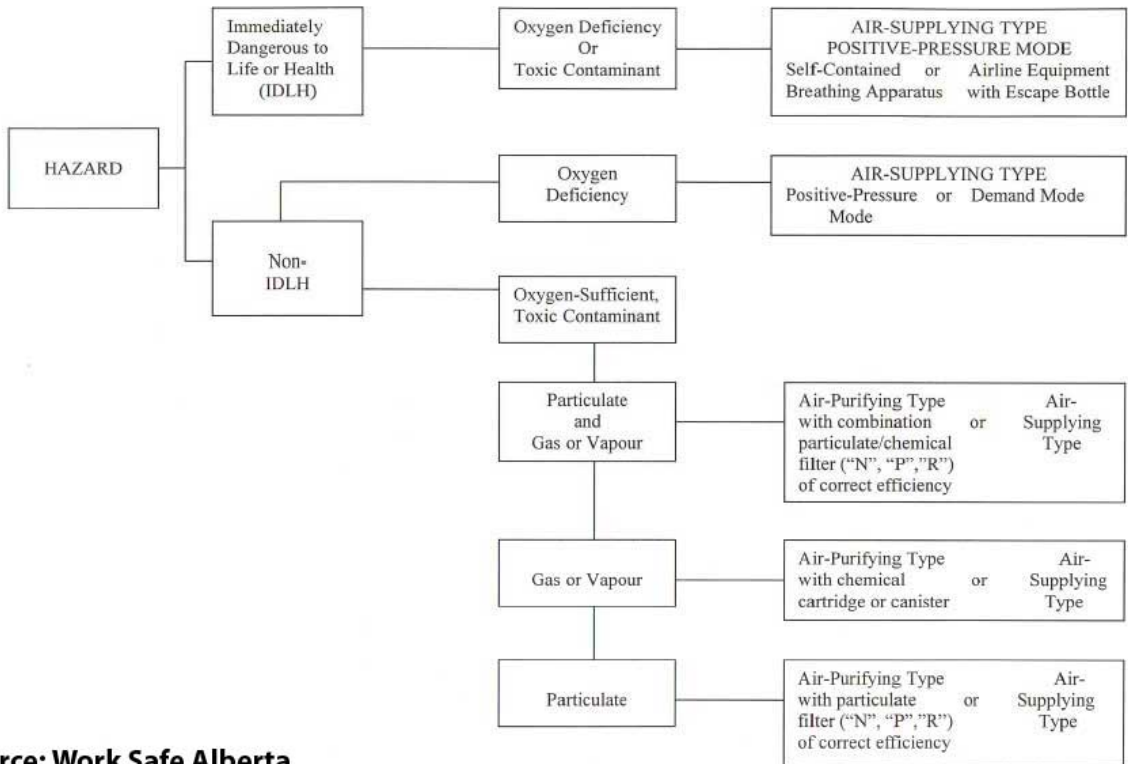
- Supplied-air (airline) respirators;
- Combination supplied-air (airline) respirator with auxiliary self-contained air supply; and
- Self-contained breathing apparatus (SCBA).

Respirators have an "Assigned Protection Factors" (APF) that reflects the anticipated level of respiratory protection it would provide if it was properly functioning, properly fitted and used by a trained worker.

Insider Says: There's a third category of respiratory protection—escape respirators, which are used only for emergency escape from contaminated areas, such as when there's a gas leak or toxic spill. Escape respirators are available in both air-purifying or air-supplying forms.

(Click the image for a larger version)

Choosing an Appropriate Type of Respiratory Protective Equipment



Source: Work Safe Alberta