

# Respiratory Protective Equipment (RPE)

## RPE use on a coal mine

Coal mine workers can sometimes be exposed to harmful airborne contaminants, such as dusts and gases. While mines should aim to reduce exposures using higher-order controls, respiratory protective equipment (RPE) plays a vital supplementary role when these controls aren't completely sufficient. It is important to note that RPE, as the lowest measure on the hierarchy of controls, must not be relied upon as a primary or long-term solution. When it is used, its selection, use, and maintenance must comply with Australian Standard AS/NZS 1715:2009. Workers must understand the limitations of RPE and how improper use can compromise their health.

Every coal mine should establish a respiratory protection program that clearly identifies areas, tasks, and activities requiring RPE. This program should include appointing a program administrator to oversee policy development, selection, training, and auditing. It is essential to conduct regular fit testing, provide training on correct use, and maintain thorough records of RPE use and inspections. Annual reviews should be conducted to ensure the program's ongoing effectiveness and compliance.

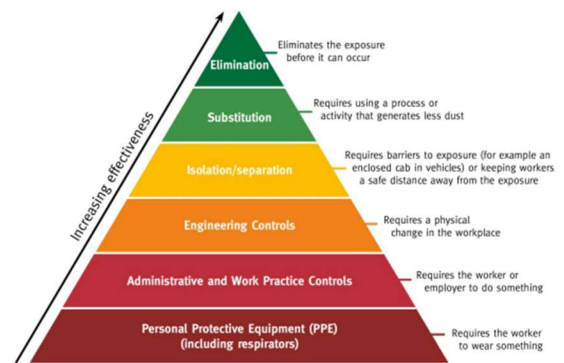


Figure 1: Hierarchy of controls

## Selection, use, and maintenance of RPE

The selection, use, and maintenance of RPE are critical to ensure its effectiveness.

### Selection:

RPE should be chosen based on the type of contaminants, the tasks being performed, and compatibility with other PPE. Selection must comply with AS/NZS standards and consider the limitations of different devices. Competent, trained individuals should oversee the process to ensure appropriate equipment is provided.

### Use:




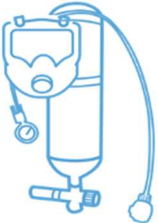
Proper use involves ensuring a correct fit, wearing RPE continuously in designated areas, and performing fit checks (negative/positive pressure) before each use. Workers must remain clean-shaven where a facial seal is required. Training should include techniques for correct donning and doffing, filter installation, and recognising when filters need replacement.

### Maintenance:

Disposable masks should be discarded after each use. Reusable masks must be cleaned regularly, stored in clean, dry conditions, and inspected for damage. Filters should be replaced regularly as per manufacturers' specifications. PAPR systems require regular inspection of hoses, seals, and airflow, with maintenance scheduled every 3-6 months.

# Commonly used RPE in coal mines



Table 1: Commonly used RPE in coal mines

	Type of RPE	Description	Example of Use	Fit Testing	Maintenance Requirements
	<b>Disposable Masks (P2/P3)</b>	Lightweight, single-use masks that filter out particulate matter.	Tasks involving dust and other particulates.	Qualitative or Quantitative	Discard after single use.
	<b>Reusable Half-Face Masks</b>	Tight-fitting masks with replaceable filter cartridges for particulates (P2/P3) and/or gases (ABE Class).	Tasks involving high contaminant levels to dusts and/or toxic gases such as paint fumes, welding fumes and gases.	Qualitative or Quantitative	Inspect daily, clean after use, replace filters weekly/monthly as required.
	<b>Powered Air Purifying Respirators (PAPR)</b>	Helmets with a fan and filter assembly supplying positive-pressure filtered air. Fitted with replaceable filter cartridges for particulates (P2/P3) and/or gases (ABE Class).	Tasks involving very high contaminant environments such as compressed air cleaning dragline MG sets or FCAW welding.	Quantitative	Inspect hoses/seals and flow rate daily, clean after use, replace filters weekly/monthly as required and service every 3-6 months.
	<b>Air-Supplied Respirators</b>	Helmets supplied with clean air from a compressor.	Tasks conducted in confined spaces and / or areas with very high contaminant levels that may pose an immediate risk to health.	Quantitative	Inspect hoses/seals and flow rate daily, clean after use, replace filters weekly/monthly as required. Test compressor 'Air Quality' every 6–12 months (AS 1715 App A) and inspect/ replace in-line filters.

# Fit testing and facial hair

Fit testing ensures that the RPE type and size selected, provides an effective seal to the worker's face. There are two types of fit testing:

**Table 2: Fit testing methods**

	Fit Testing Method	Description	Pros	Cons
	<b>Qualitative Testing</b>	Worker wears RPE inside an enclosure containing a low toxicity test substance. If the worker can smell or taste the test substance this indicates leakage and an inadequate seal.	Inexpensive, quick, simple.	Subjective, less reliable.
	<b>Quantitative Testing</b>	Worker wears an RPE device connected to a particle counting detector. The atmosphere inside and outside the respirator is sampled through a probe. A series of tests and movements are undertaken during the assessment to test the efficiency of the seal.	Objective test, data-driven, reproducible, reliable.	Expensive, time-consuming.

Fit testing should be conducted annually or if there are significant facial changes.

Workers must also perform daily **fit checks** before use, to ensure the RPE is fit for purpose.

Facial hair, scars, and interference from other PPE can compromise the seal and effectiveness of RPE. Workers must be clean-shaven where the mask seals to the face. Facial hair, including beards, moustaches, sideburns and stubble, between the sealing surface of a tight-facing facepiece and the face will stop the respirator from sealing properly.



**Figure 2: Facial hairstyle and RPE use. Image sourced from CDC NIOSH 2017**

# Training requirements

All coal mine workers required to wear RPE must receive comprehensive training. This training should cover:

- Identified airborne contaminants and the tasks requiring RPE.
- Proper fitting, use, and limitations of each type of RPE.
- Maintenance, storage, and filter replacement procedures.
- The impact of facial hair on the effectiveness of tight-fitting masks.
- The importance of proper wear time to ensure protection.
- Training records, including fit testing results, must be maintained and reviewed regularly.

# Protection factors (PFs)

Protection Factors (PFs) are ratings assigned to different types of RPE to indicate the level of protection they provide under controlled, laboratory-tested conditions. They are essential for selecting appropriate RPE to match the type and concentration of airborne contaminants present in the workplace. However, it is important to note that PFs represent theoretical maximum protection. They may not reflect real-world performance and therefore should not be used to assess actual worker exposure levels. Workplace exposure monitoring must measure unprotected exposure levels to ensure compliance with Occupational Exposure Limits (OEL). Mines should focus on reducing exposures to as low as reasonably achievable (ALARA) using higher-order controls and only rely on RPE as a supplementary measure.

When selecting RPE, PFs should guide decision-making but always consider task-specific requirements, worker comfort, and the need for proper training and fit testing to ensure optimal protection.

A PF of 10 means the respirator, in standardised laboratory tests, reduces the contaminant concentration by a factor of 10 (e.g., from 100 mg/m<sup>3</sup> to 10 mg/m<sup>3</sup> inside the mask).

**Table 3: Respiratory type and protection factor**

Respirator Type	Typical Protection Factor*
Disposable Masks (P1/P2)	Up to 10
Reusable Half-Face Masks (P2/P3)	Up to 10
Reusable Full-Face Mask (P2/P3)	Up to 50/100
Powered Air Purifying Respirators (PAPR-P2/P3)	Up to 50/100+
Air-Supplied air-line Respirators	100+

\*The protection factor for specific RPE type used should be checked against AS1715 Table 4.2 & 4.3, for particulates and Table 4.5 for gases and vapours.

# Limitations of RPE

While RPE is selected to provide protection, in practice its effectiveness can be compromised by the following:

- **Workplace Conditions:**  
Real-world conditions, such as worker movement, temperature, and humidity, can reduce the actual level of protection provided compared to laboratory tests.
- **Fit and Seal:**  
RPE effectiveness depends heavily on achieving a proper seal to the face. Issues such as facial hair, scars, or not maintaining a proper fit throughout the shift, can compromise protection, regardless of the PF rating.
- **Wear Time:**  
Workers often remove RPE to communicate, drink, or due to discomfort, reducing its overall effectiveness. The PF assumes continuous wear.
- **Maintenance and Filter Changes:**  
Improper storage, failure to replace filters, or using damaged equipment can lead to reduced protection.

Given this, it remains the view of the RSHQ Coal Inspectorate that wherever possible, exposures are to be reduced to below the OELs and to as low as reasonably achievable, without considering the potential protection that may or may not be afforded by RPE when worn in practice. Mines should prioritise higher-order controls to reduce exposure to contaminants and use RPE as a supplementary measure.

## More information

For more details, visit:

- AS/NZS 1715: 2009 Selection, use and maintenance of respiratory protective equipment\*
- RespFit
- WorkSafe QLD - Fit Testing Flyer
- HSE Fit Testing Basics

\*Note: AS/NZS is currently under review. This factsheet will be updated and additional information will be provided as necessary.