

Enhancing Respiratory Protection in Mining

Xiaoliang Wang¹, Judith C. Chow¹, John G. Watson¹, Jocelyn Najera¹, Diane K. Hale², Dahiana Pimentel², James Lage³, and Robert Lage³

¹Desert Research Institute (DRI), Reno, NV

²Best in the West Safety, Las Vegas, NV

³Sonoma Health & Safety Center, Winnemucca, NV

May 7, 2025

Section 1

Respirator Basics to Safeguard Miner Health



What Is a Respirator?

- Respirators are protective devices—used as a **last resort**—to **reduce** workers' harmful exposures to airborne hazards, including oxygen-deficient atmospheres.
- Respirators provide protection by:
 1. Filtering or removing airborne contaminants (e.g., respirable crystalline silica, or a combination of contaminants from the air) using filters, cartridges, or canisters (**air-purifying**).
 2. Supplying an independent source of clean breathing air (**atmosphere-supplying**).

Only respirators approved by the National Institute for Occupational Safety and Health (NIOSH) shall be used.



Describe Your Thoughts About Wearing a Respirator in Three Words



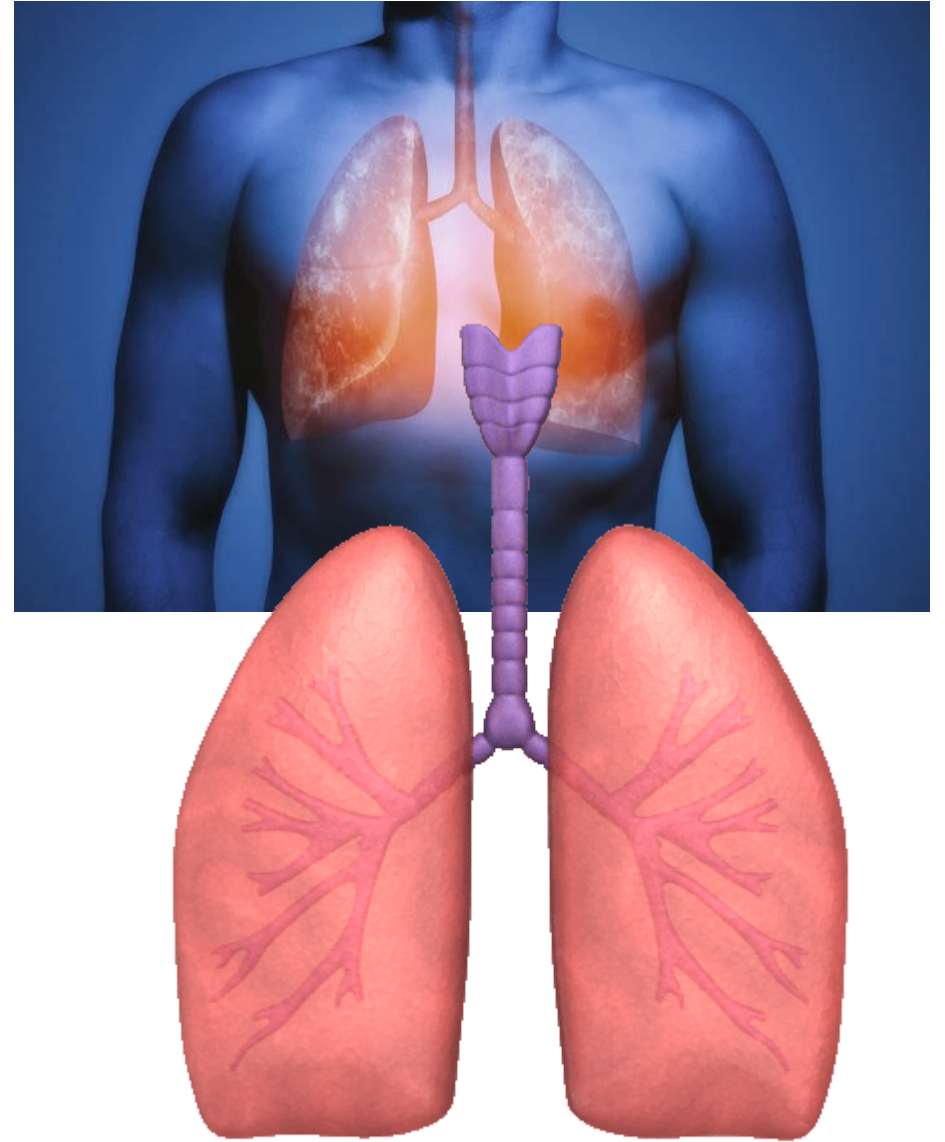
Why Don't Miners Wear Respirators?

- Not needed
- Uncomfortable or too hot
- Difficult to breathe
- Poor fit
- Cannot hear or see clearly
- Not available near work tasks
- Unattractive



Why Should You Care?

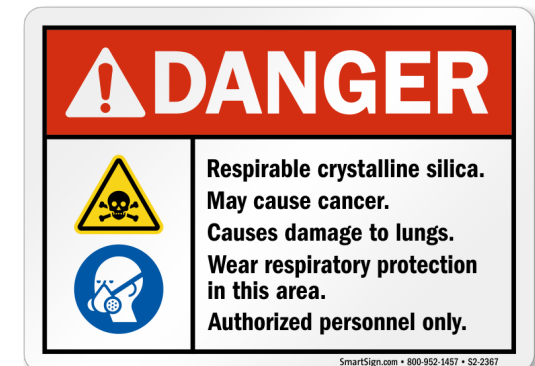
- Respiratory protection safeguards lungs from chemicals, gases, particles, or other environmental hazards.
- Missing or inadequate respiratory protection can cause permanent lung damage or death, even after brief exposure.



You Only Have ONE SET OF LUNGS

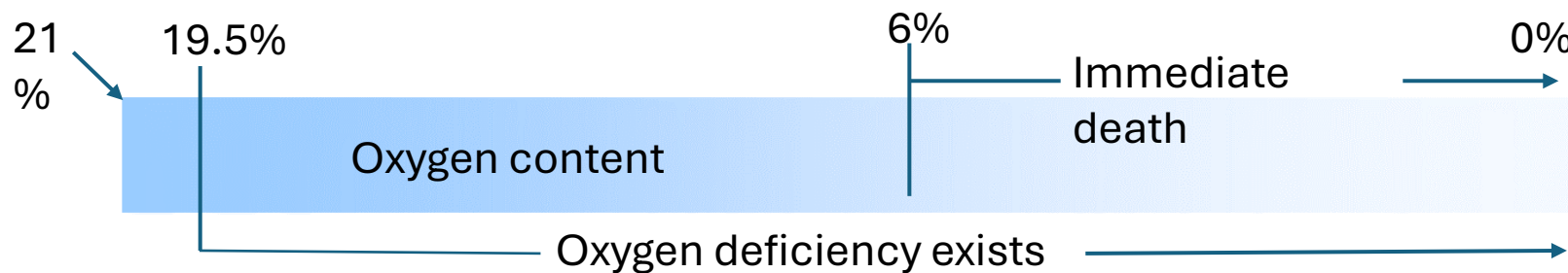
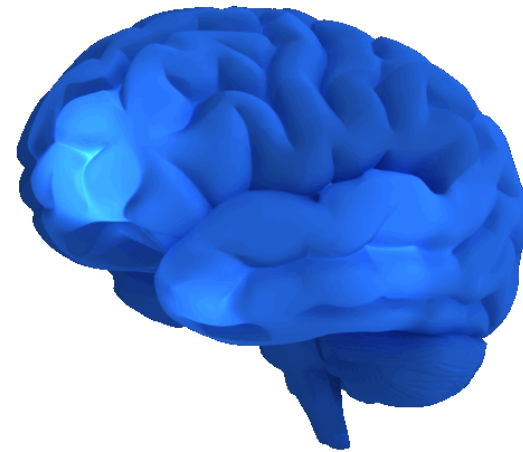
Why Are Respirators Necessary?

- Chemical vapors
- Toxic gases (CO, H₂S, NO_x, SO₂, acidic gases, etc.)
- Diesel particulate matter (DPM)
- Respirable crystalline silica (RCS)
- Metal-containing mine dust
- Asbestos
- Oxygen deficiency



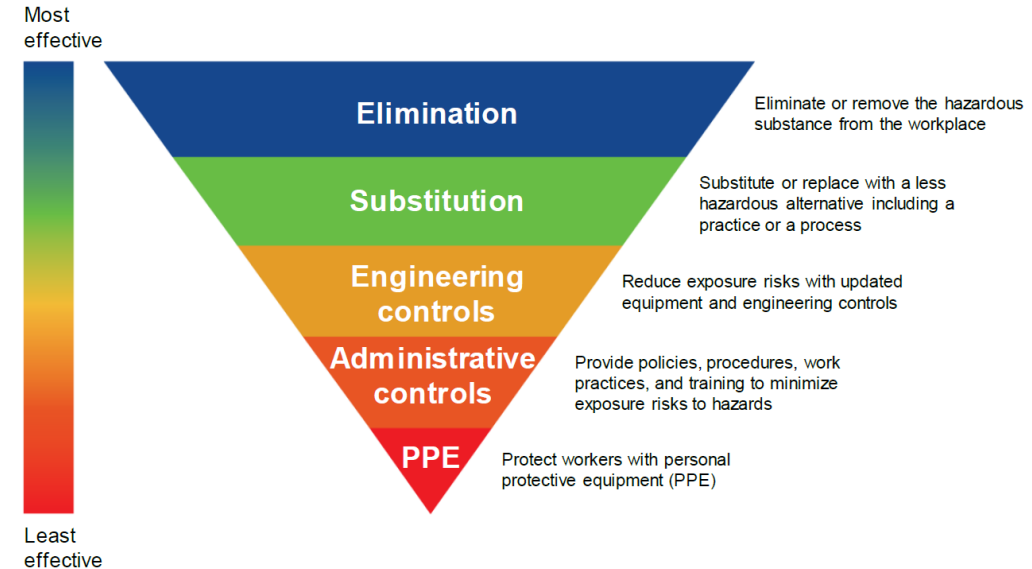
What is Oxygen Deficiency?

- Oxygen deficiency can occur in confined or enclosed spaces, during fires or large chemical releases.
- Normal air contains 21% oxygen by volume; <19.5% is “oxygen deficient”.
- Air in all active workings shall have at least 19.5% oxygen.
- Only an atmosphere-supplying respirator can protect against oxygen deficiency.



Hazards Need To Be Controlled First

- Elimination: Most preferred
- Substituting: Use less toxic material
- Engineering controls:
 1. Suppress (e.g., water spray and wetting agents)
 2. Dilute (e.g., ventilation)
 3. Divert (e.g., barriers and ventilation)
 4. Capture (e.g., dust collectors)
- Administrative controls:
 1. Training
 2. Housekeeping
 3. Etc.
- PPE (Respirators): Last line of defense



When Are Respirators Needed?

- When concentrations exceed permissible exposure limit (PEL), but engineering controls are being developed and implemented.
- When it is necessary by the nature of work involved (for example, occasional entry into hazardous atmospheres to perform maintenance or investigation).
- When air contamination is suspected, but levels are unknown.
- When there is an oxygen-deficient atmosphere.



Why Are Respirators the **LAST LINE OF DEFENSE?**



Photo courtesy of Best in the West Safety

- They do not eliminate the hazard.
- They can be hot, uncomfortable, and make it hard to see or communicate.
- They can make it difficult to breathe normally.
- They can be easily removed by the wearer in a contaminated area.

Respirators have MAJOR limitations.