

Enhancing Respiratory Protection in Mining

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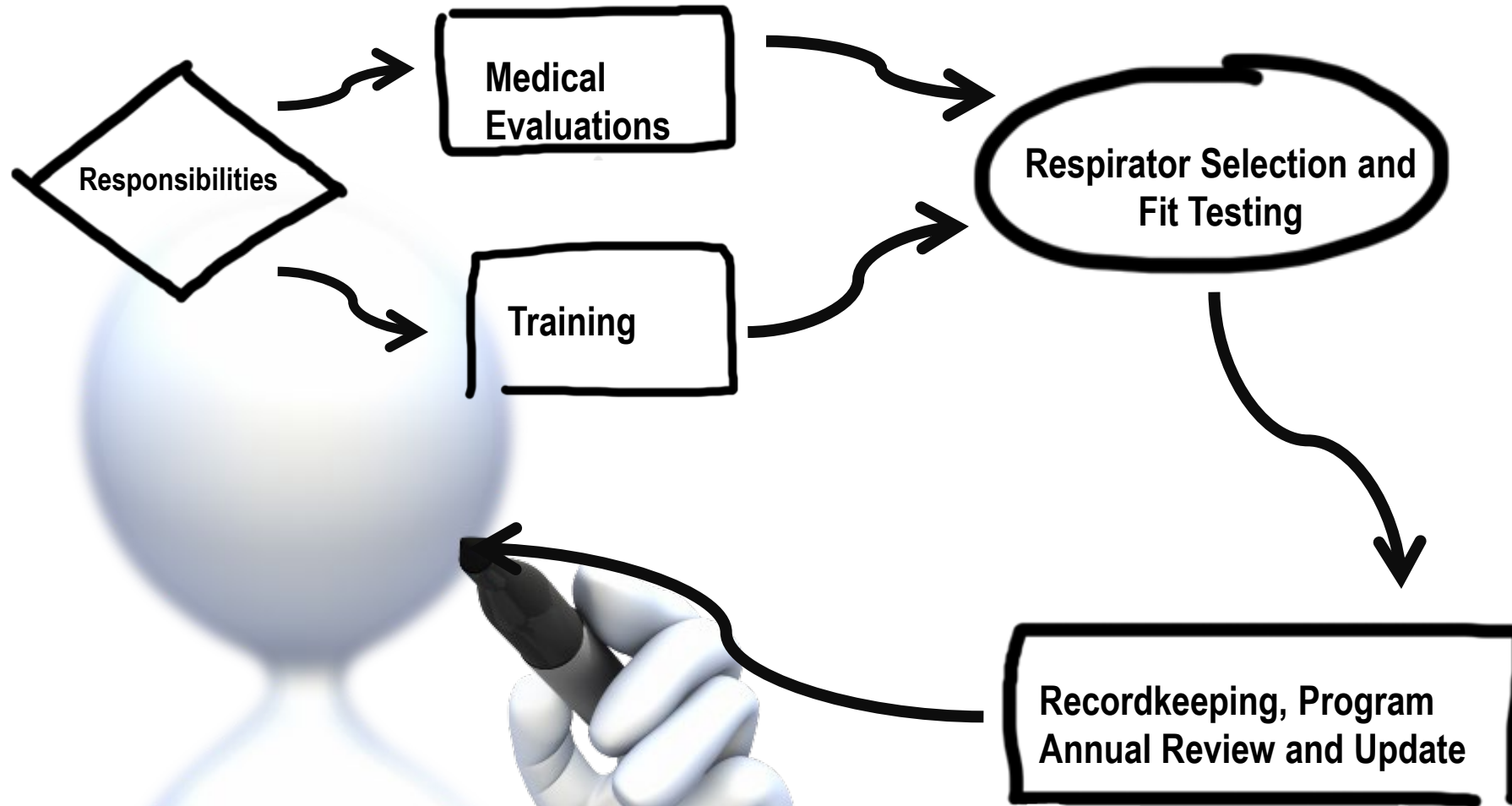
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Section 6

Respiratory Protection Program

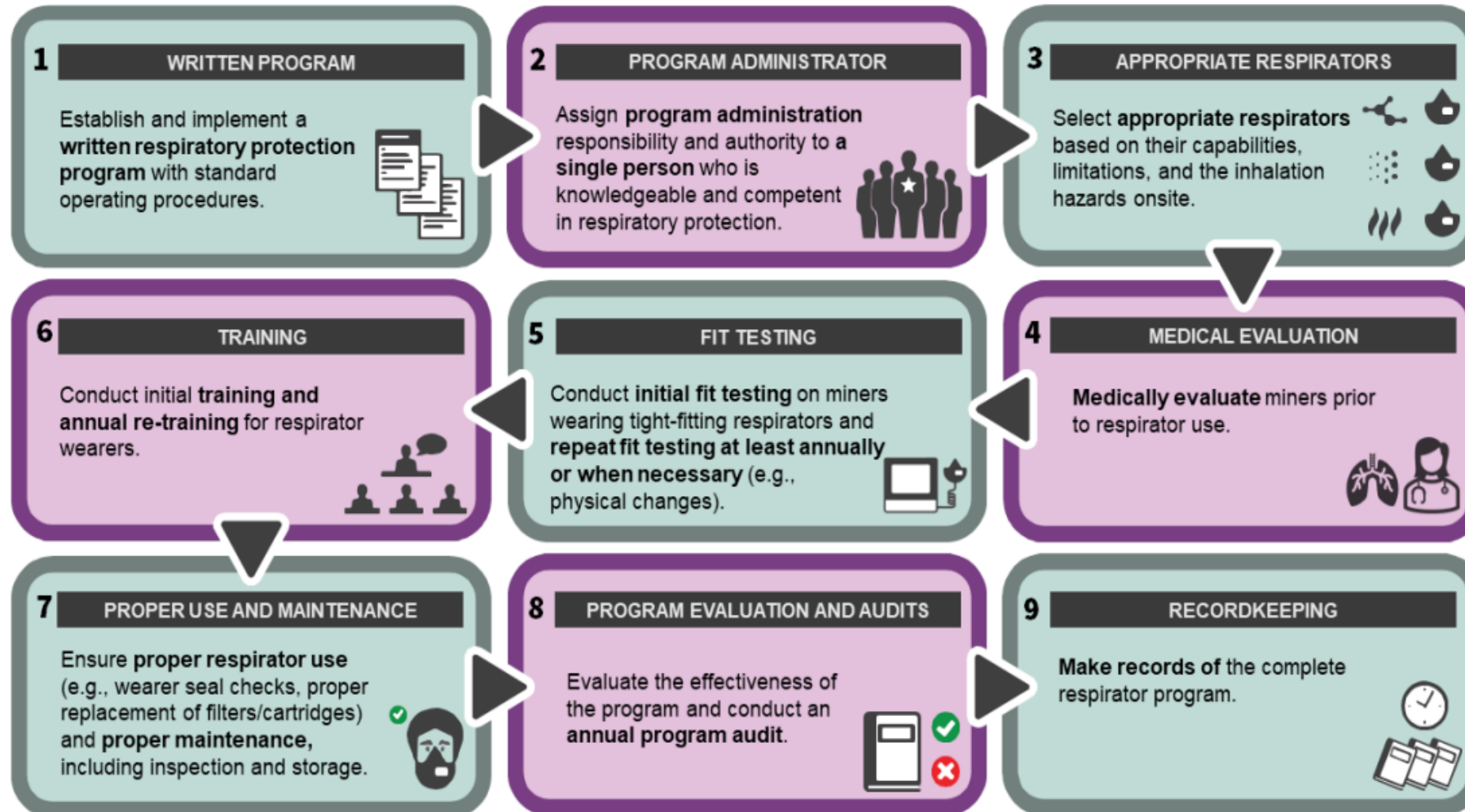




Respiratory Protection Program

Key Requirements of ASTM F3387-19

Respiratory Protection Standard Practices



Standard Operating Procedures (SOP) for Respirator Use

1. Hazard assessment;
2. Respirator selection;
3. Medical evaluation;
4. Training;
5. Fit testing;
6. Issuance;
7. Maintenance, inspection, and storage;
8. Air-purifying element change schedule;
9. Breathing air quality;
10. Monitoring respirator use;
11. Hazard re-evaluation;
12. Mine Operator policies;
13. Program evaluation and auditing.

Exposure Assessment: When Is It Needed?

- When miners can be exposed to respiratory hazards and/or they are required to wear respirators. Including, but not limited to:
 - When MSHA has a substance-specific PEL (e.g., respirable crystalline silica, diesel particulate matter, etc.).
 - When miners complain of odor, headache, irritation [i.e., eye, nose, and throat (ENT)] or are experiencing other adverse health effects.



Determine the Nature of the Airborne Hazard(s)

- Are they particulates (dust, fume, mist, and smoke), gases/vapors, or mixtures?
- Review safety data sheets (SDSs): Hazard(s) Identification and Exposure Controls/Personal Protection
- Are they biological hazards (bacteria, mold, spore, fungi, and virus)?
- Are they irritating or corrosive to the eyes or skin?
- Are there any mandatory or recommended occupational exposure levels for the contaminants?
- Is it Immediately Dangerous to Life or Health (IDLH), including oxygen deficiency?

Determine the Airborne Concentration of Each Hazardous Contaminant

- Personal exposure monitoring:
 - Collect samples from miners' breathing zone;
 - Utilize methods appropriate for contaminant(s);
 - Sample the worst-case exposures and representative shifts and operations to determine the range of exposures.
- Mathematical modeling or estimating based on the workplace volume and physical properties.
- Experience from similar circumstances and materials.

Determine the Hazard Ratio (HR) and Maximum Use Concentration (MUC)

- Hazard Ratio (HR) = (Concentration of a Contaminant) / (Exposure Limit) in the same units.
- The respirator assigned protection factor (APF) shall be greater than HR.
- Maximum use concentration (MUC) = Exposure limit \times APF: the maximum concentration of a hazard from which a miner can be protected by a respirator.

Assigned Protection Factors (APF)

Type of respirator	Quarter mask	Half facepiece	Full facepiece	Helmet hood	Loose-fitting facepiece
1. Air-Purifying Respirator	5	10	50		
2. Powered Air-Purifying Respirator (PAPR)		50	1,000	25/1,000	25
3. Supplied-Air Respirator (SAR) or Airline Respirator					
• Demand mode		10	50		
• Continuous flow mode		50	1,000	25/1,000	25
• Pressure-demand or other positive-pressure mode		50	1,000		
4. Self-Contained Breathing Apparatus (SCBA)					
• Demand mode		10	50	50	
• Pressure-demand or other positive-pressure mode (e.g., open/closed circuit)			10,000	10,000	

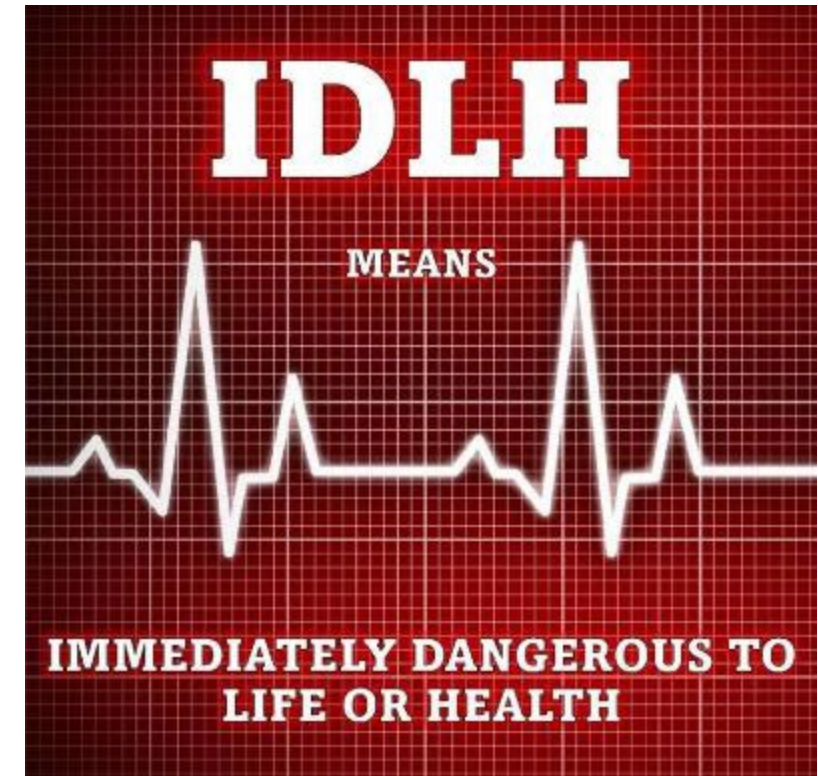
APF is the minimum expected workplace level of respiratory protection that would be provided by a properly functioning and used respirator to properly fitted and trained wearers when all elements of an effective respiratory protection program are established and being implemented.

Example of Respirator Selection Based on HR and APF

- A miner is working in an environment with a respirable crystalline silica concentration of $600 \mu\text{g}/\text{m}^3$ while engineering controls are being implemented.
- $\text{HR} = 600 \mu\text{g}/\text{m}^3 / 50 \mu\text{g}/\text{m}^3 = 12$.
- The half-facepiece (APF = 10) is not protective enough. The miner needs to use a full-facepiece (APF = 50) or a PAPR with a high-efficiency (HE) or P100 filter.
- For a respirator with APF = 50, $\text{MUC} = 50 \times 50 = 2500 \mu\text{g}/\text{m}^3$ for RCS.

Is There an IDLH Atmosphere?

- The concentration of a contaminant is known or suspected to be above the IDLH level.
- The identity or concentration of a contaminant is unknown.
- The oxygen level is below 19.5% by volume.



Refer to ASTM F3387 – 19 Annex 3 for more information about oxygen deficiency.

Respirators for IDLH Atmospheres

- MSHA requires the most protective level of respiratory protection in IDLH conditions (full-face pressure-demand SCBA or combination airline/SCBA).
- Air-purifying respirators are not permitted in IDLH conditions.
- Supplied-air respirator (SAR) or airline respirator are not permitted in IDLH conditions.



Particulate Filter Change Out Schedules

- Particulate filters cannot be cleaned.
- Replace particulate filters if damaged or if difficult to breathe through.
- Replace HE filters (PAPR) when minimum airflow cannot be maintained.
- N-series filters are typically replaced at the end of shift in dusty conditions.
- Replace R-series filters after 8 hours of use (continuous or intermittent) when oil is present.
- Always follow manufacturer's instructions.
- Use the manufacturer's online change out selection process as guidance.

Cartridge and Canister Change Out Schedules

1. Gather workplace data: exposure concentration of each airborne contaminant, temperature, humidity, breathing rate, and work duration.
2. Estimate end-of-service life:
 - Use laboratory or workplace testing;
 - Use the manufacturer's recommendations;
 - Use software from manufacturers, NIOSH, or OSHA.
3. Adjust the end-of-service life estimate for your workplace.
4. Establish a change schedule.
5. Verify change schedule.

Refer to ASTM F3387 – 19 Annex 1 for more information about cartridge and canister change out schedules.

Comfort Is an Important Factor in Wearer Acceptance of the Respirator

- No one size or model of respirator will fit all types of faces. A variety of sizes, models, and styles from which to choose shall be provided for the wearer.
- Consider breathing resistance, vision, communications, and weight.
- If a fit test show that a miner can be properly fitted with two or more models, he/she shall be permitted to use the preferred respirator model.

Special Considerations for Emergency “Escape-Only” Respirators

1. A hazard assessment to determine if respirators for escape are required during an emergency.
2. An adequate number of escape respirators shall be provided and accessible where they may be needed.
3. Personnel assigned to areas where escape respirators may be required shall be enrolled in the complete respiratory protection program, including medical evaluation and training in the use and limitations of escape respirators.
4. Visitors and personnel not assigned to work areas where escape respirators are required shall be trained in how to don and use the escape-only respirator.

Emergency and Rescue Use Respirator Storage

- Shall be quickly accessible at all times.
- Shall be stored in compartments marked for emergency use.
- Shall be stored following manufacturer's instructions.
- Shall be stored in airtight bags away from contaminated environments.
- Shall be certified and documented by inspection, and by tagging the information either to the respirator or its compartment, or storing it with inspection reports.

Breathing Gas Quality (Atmosphere-Supplying Respirators)

- Only high-purity compressed gaseous air, reconstituted synthetic air (blended 21 % oxygen and 79 % nitrogen), compressed gaseous oxygen, liquid air, or liquid oxygen shall be used for respiration.
- Water content dew point should be lower than the lowest ambient temperature to prevent condensation or freezing.
- Monitor carbon monoxide (CO) if the compressor is powered by an internal combustion engine.
- Periodically monitor air quality.

Respiratory Protection Program Audit

- Ongoing surveillance and annual audit by the administrator.
- An outside audit shall be performed with frequency determined by size and complexity of operation and previous audit findings.

Audit items:

- 1) Respiratory protection program
- 2) Program administration
- 3) Training
- 4) Medical evaluation
- 5) Fit testing
- 6) Air sampling and classification of hazard(s)
- 7) Selection and issuance
- 8) Use
- 9) Equipment cleaning, maintenance, and inspection
- 10) Breathing air quantity and quality
- 11) Storage
- 12) Emergency preparedness
- 13) Special problems
- 14) Corrective action

Recordkeeping



- Respiratory protection program
- Medical evaluation
- Hazard assessment
- Respirator selection
- Emergency respirator inspection
- Breathing-air system inspection and maintenance
- Training
- Fit testing
- Program evaluation

Other Items to Be Considered by Mine Operators

- Any expense related to respiratory protection program will be paid by the mine operator.
- The person doing the fit testing does not need to be a healthcare provider; facility staff can learn to conduct fit tests.
- Find an occupational medicine clinic or an occupational medicine provider for medical evaluation.
- Do not send miners to their primary care doctor.
 - Their healthcare insurance will be billed; the mine operator is required by law to cover the cost of this expense.
 - Their doctor may not know or understand the risks of using the respirator.

Questions?



- **Concerns or questions?**