Choosing the Right Respirator

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Selecting respirators to help protect workers from airborne contaminants can be a confusing process. The consequences of selecting the incorrect respirator can adversely impact worker safety and health.

Often, multiple respiratory hazards are present in a workplace, and some exposures are unknown. Additionally, the person responsible for selecting respirators or administering a respirator program may not be a certified industrial hygienist or safety professional, and may have limited experience or expertise in this area.

The professional reputations of those responsible for worker safety may be damaged, and a company may be cited by OSHA or workers' compensation claims could increase if the right respirators are not selected. However, plant engineers who follow a systematic approach to program administration can provide appropriate respirators for their workers and comply with government regulations.

When used in the workplace, a formal respiratory protection program must be established covering the basic requirements outlined in the OSHA Respiratory Protection Standard (29 CFR 1910.134). Education and training must be properly emphasized and conducted periodically. Maintenance, cleaning and storage programs must be established and routinely followed for reusable respirators.

Employers must match expected protection needs with the respirator models available. An important consideration is that the respirator selected must protect the worker while allowing him or her to perform the job effectively, and must meet the needs of the respirator program.

Four-step approach for establishing an OSHA-compliant program helps simplify the respirator selection process

Where feasible, employers must eliminate contaminants by using engineering controls (such as general and local ventilation, enclosure or isolation, and substitution of a less hazardous process or material). But when effective engineering controls are not feasible, employers must look to personal respiratory protection equipment to help prevent exposures to workplace contaminants above specified levels.

The process of establishing a respiratory protection program can be broken down into four basic steps:

- Identify respiratory hazards and concentrations
- Understand the contaminants' effects on workers' health
- Select appropriate respiratory protection
- Train workers in proper respirator use and maintenance.

These four steps are the foundation for establishing a basic respiratory protection program. Be sure to consult state and federal OSHA requirements to ensure that the program is compliant. Leading industrial respirator manufacturers should be able to assist with on-site training and education in this four-step process, in addition to helping employers train their workers and conduct respirator fit testing.

Determining the Hazard

Selecting the appropriate protection involves determining the hazards and choosing the proper type of respirator. The employer must conduct a hazard assessment to establish the rationale for selecting the appropriate type of respiratory protection. Hazard assessment includes several steps.

- Identify the contaminants in the workplace. Good sources of information may include Material Safety Data Sheets, process and plant engineers, and maintenance personnel.
- Check for published Threshold Limit Value (TLVs), Permissible Exposure Limit (PELs), any other available exposure limits, and Immediately Dangerous to Life and Health (IDLH) information. References for this information include Occupational Safety and Health Administration health standards (29 CFR 1910.1000 and others), TLVs and Biological Exposure Indices published by the American Conference of Governmental Industrial Hygienists (ACGIH), Workplace Environmental Exposure Level (WEEL) Guides series published by the American Industrial Hygiene Association (AIHA), National Institute for Occupational Safety and Health (NIOSH) recommended exposure limits, and supplier recommendations on MSDS.
- Check if work environment is oxygen-deficient. Monitoring the environment for oxygen content may be necessary.
- Check the physical state of the contaminant: Is it dust, mist, fume, gas, vapor or combination? Check the vapor pressure of an aerosol against the temperature extremes of the workplace.
- Determine the concentration of contaminants — measure the time-weighted averages and peak exposures.
- Check other routes of entry besides respiratory such as skin absorption; and other health effects such as sensitization, irritation, and corrosion to skin or eyes.
- For gas and vapor contaminants, determine if there are odor, taste, or irritation warnings. A gas or vapor with good warning properties will allow detection of contaminants at concentrations below recommended exposure limits.

Selection

After the hazard assessment is done, selecting a respirator type can be started. In cases of unknown contaminants or concentrations, IDLH concentrations and/or oxygen-deficiency, a self-contained breathing apparatus (SCBA) or combination airline respirator is required.

When the contaminant concentration can be measured or estimated, a hazard ratio for each contaminant is calculated by dividing the measured concentration by the exposure limit or guideline to determine if respiratory protection is required. A respirator with an assigned protection factor (APF) greater than the calculated hazard ratio should be selected. In addition, the cartridge chosen must be appropriate for the contaminant (for example, an organic vapor cartridge for xylene or an acid gas cartridge for hydrochloric acid).

When a gas or vapor contaminant is present, the employer may use an air-purifying respirator with a chemical cartridge changeout schedule or an airline respirator. For environments where both gas, vapor and particulate exposures are anticipated, such as paint spraying or pesticide applications, a chemical cartridge along with a particulate filter may be necessary.

Styles

Industrial respirators are categorized into two groups: positive and negative pressure.

Positive pressure respirators provide a flow of clean breathing air to the user from a compressor, compressed air cylinder, portable pump, or powered air purifier. Positive pressure systems may consist of helmets, hoods, full-face or half-mask respirators.

Negative pressure respirators help remove airborne contaminants as the worker breathes ambient air through filters and/or cartridges. These respirators are tight-fitting and available in half- and full-facepiece models.

Positive pressure systems are used primarily when concentrations of contaminants are greater than ten times the Permissible Exposure Limit (10 X PEL). Powered Air Purifying Respirators (PAPR) and continuous flow airline respirators are designed so the flow of air is continuous during both inhalation and exhalation; and there is minimal breathing resistance, resulting in a longer and more comfortable wear time.

Positive pressure systems may be desirable for reasons other than providing respiratory protection alone, such as supplemental protection and/or worker comfort. Helmets, hoods and full-facepiece respirators also help protect the eyes, face, and/or head.

Some systems allow heating or cooling of the supplied air to the worker's head and upper body, alleviating temperature discomfort. Workers with facial hair that interferes with the faceseal of a negative pressure respirator may wear a positive pressure hood or helmet instead.

Negative pressure respirators generally are simpler and less expensive than positive pressure types. Negative pressure respirators are categorized into two types: filtering facepiece particulate and elastomeric. Both types meet or exceed NIOSH requirements for service life, breathing resistance, filter efficiency, and quality assurance; and provide excellent comfort and face fit that can be qualitatively or quantitatively tested.

Elastomeric facepieces are further classified into three types: maintenance-free, low-maintenance, and conventional-maintenance.

Maintenance-free, half-mask particulate respirators carry approvals with regards to their filter efficiency in oily environments. The elastomeric facepiece respirators carry a variety of approvals depending upon how they are equipped. Some elastomeric respirators are packaged in the factory pre-assembled, have no spare parts, are designed not to be disassembled, and used until the filter or cartridge medium is loaded or the assembly is damaged. Because they are assigned to just one worker, maintenance-free respirators provide high levels of worker hygiene, convenience, and acceptance. They are typically used in facilities that do not have a respirator cleaning and maintenance program. Pre-assembled respirators eliminate worker error that may occur with replaceable parts.

Low-maintenance respirators feature a low-cost facepiece with replaceable filters and cartridges. They have limited spare parts (valves or straps) to be replaced, lost, or stored in inventory. These models can be assigned to a single worker or rotated among more than one employee, following appropriate cleaning and maintenance procedures. Initial cost is slightly more than a maintenance-free respirator, but reuse, by changing filters and cartridges, may allow savings.

Conventional-maintenance respirators are designed for heavy use, multiple reuse, and maintenance; and are assembled with replaceable components. These respirators generally require an inventory of spare components and knowledge of proper assembly and disassembly. An advantage with this type is that the filters and cartridges may be switched out to allow work in different contaminated environments.

Training

Training in proper use and maintenance is the fourth step in a basic respiratory protection program. This step requires the employer to train — and retrain — each user about the entire program. Employees need to understand the types of respiratory hazards to which they are likely to be exposed, and the effect on them, if the respirator is not used.

Additionally, plant workers need a practical understanding of why a particular respirator was selected, along with its capabilities and limitations. Finally, they must be trained in the proper way to wear the respirator, check its fit, and operation. And in most cases, they must be fit tested, a required element in a respiratory protection program.

The OSHA Respiratory Protection Standard requires fit testing for all tight fitting facepieces. Whether you select a maintenance-free or reusable respirator, the wearer must obtain a satisfactory fit as indicated by a qualitative or quantitative fit test. Worker comfort must also be considered. Removal of the respirator, even for short periods of time, dramatically reduces the protection.

Be sure to consider all the protective equipment required for the job. The respirator selected must be compatible with hard hats, goggles, glasses, welding hoods, faceshields, etc. In addition, the worker must be able to communicate and perform required job duties without removing the respirator.

Choosing the Right Respirator

If strenuous work is performed, or if the respirator is worn for an extended period of time, it may be desirable to select a lightweight model with low breathing resistance. If a respirator does not have good worker acceptance and does not stay on the face, it does not provide the protection needed.

Role of Program Administrator

OSHA places the burden of responsibility for virtually all aspects of managing a respirator protection program on the employer, including determining which specific work operations require the use of protective equipment. The employer must provide appropriate respirators to meet the needs of each specific operation and designate a program administrator to manage employee training, fit testing, and record keeping.

Work superintendents, supervisors, or group leaders of each area, especially the respirator program administrator, are responsible for ensuring that all personnel under their control are completely knowledgeable of the respiratory protection requirements for the areas in which they work. They also ensure that their employees receive proper training, medical evaluation, and fit testing; and comply with all facets of the OSHA respirator program, including selection, inspection, use, and maintenance.

Employees are expected to be aware of respiratory protection requirements for their work areas, as explained by the employer. Employees are also responsible for wearing the appropriate respiratory protection equipment and for maintaining the equipment in a clean and operable condition.

Summary

By following OSHA and the four-step process, as well as consulting with a certified industrial hygienist to help evaluate workplace contaminants and concentrations, employers can select an appropriate type of NIOSH-approved respirator and implement an effective program that helps protect the worker. However, consideration should be given to the type of respirator that best meets program needs for simplicity, convenience, cost and employee acceptance.

OSHA's Requirements for a Respiratory Protection Program [29 CFR Part 1910.134]

1. Procedures for selecting respirators for use in the workplace;
2. Medical evaluations of employees required to use respirators;
3. Fit testing procedures for tight-fitting respirators;
4. Procedures for proper use of respirators in routine and reasonably foreseeable emergency situations;
5. Procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding, and otherwise maintaining respirators;
6. Procedures to ensure adequate air quality, quantity, and flow of breathing air for atmosphere-supplying respirators;
7. Training of employees in the respiratory hazards to which they are potentially exposed during routing and emergency situations;
8. Training of employees in the proper use of respirators, including putting on and removing them, any limitations on their use, and their maintenance; and
9. Procedures for regularly evaluating the effectiveness of the program.

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