What is respiratory protection?

Respirators can be vital pieces of protective equipment in the work place. Used properly, they can help workers stay safe in a hazardous atmosphere, and in certain circumstances they can be the difference between life and death. However, workers must use them the right way, at the right time and under the proper conditions.

Sometimes, work processes or procedures may overexpose employees to chemicals. Respirator use is necessary to help reduce these exposures to safe levels. Use respirators:

- If engineering controls or administrative controls are not technically or economically feasible;
- For temporary high-exposure situations (e.g., sporadic clean-up operations or emergencies).

The Occupational Safety and Health Administration's (OSHA's) Respiratory Protection Standard for general industry (29 CFR 1910.134) lists practices and minimal requirements for an acceptable respirator program. You must establish a complete respiratory protection program when any of the following exists:

- Employees are exposed to a contaminant concentration above OSHA's permissible exposure limit (PEL);
- Employee health is at risk;
- An employer requires employees to use respirators even though the OSHA standard does not.

It's up to employers to provide suitable respirators when this equipment is necessary to protect the employees' health. Employers are also responsible for establishing and maintaining a written respiratory protection program with required work site-specific procedures for required respirator use. A suitably trained person qualified by appropriate training or experience commensurating with the program's complexity must administer the program. This person oversees the respiratory protection program and conducts the required evaluations of program effectiveness. Certain program elements may be required for voluntary use to prevent potential hazards associated with the use of the respirator.

Update the program as necessary to reflect changes in work place conditions that affect respirator use. The program requires, as applicable:

- Procedures for selecting respirators for work place use;
- Medical evaluations of employees required to use respirators;
- Fit testing procedures for tight-fitting respirators;
- Procedures for proper use of respirators in routine and reasonably foreseeable emergency situations;
- Procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding, and otherwise maintaining respirators;
- Procedures to ensure adequate air quality, quantity and flow of breathing air for atmosphere-supplying respirators;
- Employee training in the respiratory hazards to which they are potentially exposed during routine and emergency situations;
- Employee training in the proper use of respirators, including putting on and removing them, any limitations on their use and their maintenance;
- Procedures for regularly evaluating the program's effectiveness.

Voluntary use

Where respirators are not required, employers may choose to provide respirators at the employees' requests or allow employees to use their own respirators, if the respirators will not create hazards. If any voluntary respirator use is permitted, it's up to employers to provide respirator users with the information contained in Appendix D of the standard. Employees should be aware of the limitations of any respirators they use.

Employers are not required to include in a written respiratory protection program employees whose only use of respirators involves the voluntary use of filtering facepieces (dust masks).

In addition, employers must ensure any employee voluntarily using a respirator, except filtering facepieces, is medically able to use that respirator. Employers also must ensure the respirator is cleaned, stored and maintained so that its use presents no health hazard to the user.

Respirator selection

Employers are to provide a sufficient number of appropriate, National Institute for Occupational Safety and Health (NIOSH)-certified respirator models and sizes based on the respiratory hazard(s) to which workers are exposed, and work place and user factors that affect respirator performance and reliability. Use respirators in compliance with the conditions of certification.

OSHA has not decided on Assigned Protection Factors, but advice is available in the NIOSH Respirator Decision Logic.

The employer has to identify and evaluate the respiratory hazard(s) in the work place, including a reasonable estimate of employee exposures to hazard(s) and an identification of the contaminant's chemical state and physical form. When employers cannot identify or reasonably estimate employee exposure, they must consider the atmosphere to be Immediately Dangerous to Life and Health (IDLH).

These respirators are for employee use in IDLH atmospheres:

- A full facepiece pressure demand self-contained breathing apparatus (SCBA) certified by NIOSH for a minimum service life of 30 minutes;
- A combination full facepiece pressure demand supplied-air respirator with auxiliary self-contained air supply.

Respirators provided only for escape from IDLH atmospheres will be NIOSH-certified for escape from the atmosphere in which they will be used.

Employers will consider all oxygen-deficient atmospheres IDLH. However, under certain altitudes and oxygen concentrations, any atmosphere-supplying respirator may be used.

The respirator selected will be appropriate for the chemical state and physical form of the contaminant. For protection against gases/vapors and particulates in non-IDLH atmospheres use:

- An atmosphere-supplying respirator;
- An air-purifying respirator, provided that the respirator is equipped with an end-of-service-life indicator (ESLI) certified by NIOSH for the contaminant. If there is no ESLI appropriate for the contaminant, employers must implement a change schedule based on objective information or data that will ensure that canisters and cartridges are changed before the end of their service life. Employers must describe in the respirator program the information and data relied upon and the basis for the canister and cartridge change schedule and the basis for reliance on the data.

For protection against particulates in IDLH atmospheres use:

- An atmosphere-supplying respirator; or
- An air-purifying respirator equipped with a filter certified by NIOSH under 30 CFR part 11 as a high efficiency particulate air (HEPA) filter, or an air-purifying respirator equipped with a filter certified for particulates by NIOSH under 42 CFR part 84 (The presence of oil in the atmosphere does affect the selection of particulate respirators. Designations include N-not resistant to oil; R-resistant to oil; and P-oil proof); or
- For contaminants consisting primarily of particles with mass median aerodynamic diameters of at least two micrometers, an air-purifying respirator equipped with any filter certified for particulates by NIOSH.

Medical evaluation

Using a respirator may place a physiological burden on employees that varies with the type of respirator worn, the job and work place conditions in which the respirator is used and the employee's medical status. Before the employee is fit, tested or required

to use the respirator in the work place, employers must implement medical evaluations to determine the employee's ability to use a respirator. Employers can discontinue an employee's medical evaluations when he or she is no longer required to use a respirator.

Employers identify a physician or other licensed health-care professional (PLHCP) to perform medical evaluations using a medical questionnaire or an initial medical examination that obtains the same information as the medical questionnaire. (See Sections 1 and 2, Part A of Appendix C of the standard.)

The employer ensures that a follow-up medical examination is provided if an employee gives a positive response to any question among questions 1 through 8 in Section 2, Part A of Appendix C or if the initial medical examination demonstrates the need for a follow-up medical examination. This examination includes any medical tests, consultations or diagnostic procedures that the PLHCP deems necessary to make a final determination.

The medical questionnaire and examinations are administered confidentially during the employee's normal working hours or at a time and place convenient to the employee. Explain questions so that the employee understands the questionnaire's content.

Employees are given an opportunity to discuss the questionnaire and examination results with the PLHCP. Before the PLHCP makes a recommendation concerning an employee's ability to use a respirator, he or she must know:

- The type and weight of the respirator by the employee will use;
- The duration and frequency of respirator use, including use for rescue and escape;
- The expected physical work effort;
- Additional protective clothing and equipment to be worn;
- Temperature and humidity extremes that may be encountered.

The employer provides the PLHCP with a copy of the written respiratory protection program and a copy of the medical evaluation section of the standard.

Medical determination

In determining the employee's ability to use a respirator, the employer obtains a written recommendation from the PLHCP, providing the following information:

- Any limitations on respirator use related to the medical condition of the employee or the employee relating to the workplace conditions in which the respirator, including whether or not the employee is medically able to use the respirator;
- The need, if any, for follow-up medical evaluations;
- A statement that the PLHCP has provided the employee with a copy of the PLHCP's written recommendation.

If the respirator is a negative pressure respirator and the PLHCP finds a medical condition that may place the employee's health at increased risk if he or she uses the respirator, the employer may provide a powered air-purifying respirator (PAPR) if the PLHCP's medical evaluation finds that the employee can use such a respirator. If a subsequent medical evaluation finds that the employee is medically able to use a negative pressure respirator, the employer is no longer required to provide a PAPR.

Additional medical evaluations

The employer provides additional medical evaluations if:

- An employee reports medical signs or symptoms related to the ability to use a respirator;
- A PLHCP, supervisor or the respirator program administrator informs the employer that an employee needs re-evaluated;
- Information from the respiratory protection program, including observations made during fit testing and program evaluation, indicates a need for employee re-evaluation;
- A change occurs in workplace conditions (e.g., physical work effort, protective clothing, temperature) that may result in a substantial increase in the physiological burden placed on an employee.

Fit testing

Before requiring employees to use any respirator with a negative or positive pressure tight-fitting facepiece, employees must fit test them with the same make, model, style and size of respirator that they will use.

The employer ensures employees using a tight-fitting facepiece respirator pass an appropriate qualitative fit test (QLFT) or quantitative fit test (QNFT) prior to initial use of the respirator whenever a different respirator facepiece (size, style, model or make) is used, and at least annually, thereafter.

Employers conduct additional fit tests whenever the employee reports, or the employer, PLHCP, supervisor or program administrator makes visual observations of changes in the employee's physical condition that could affect respirator fit, including facial scarring, dental changes, cosmetic surgery or an obvious change in body weight.

If after passing a QLFT or QNFT, the employee subsequently notifies the employer, program administrator, supervisor or PLHCP that the fit of the respirator is unacceptable, the employer gives the employee a reasonable opportunity to select a different respirator facepiece. The employer conducts another fit test.

Administer the fit test using an OSHA-accepted QLFT or QNFT protocol contained in Appendix A of the standard. Only use QLFT to fit test negative pressure air-purifying respirators that must achieve a fit factor of 100 or less. If the fit factor, as determined through an OSHA-accepted QNFT protocol, is equal to or greater than 100 for tight-fitting half facepieces, or equal to or greater than 500 for tight-fitting full facepieces, the QNFT has been passed with that respirator.

Accomplish fit testing of tight-fitting atmosphere-supplying respirators and tight-fitting powered air-purifying respirators by performing quantitative or qualitative fit testing in the negative pressure mode, regardless of the mode of operation (negative or positive pressure) used for respiratory protection.

Accomplish qualitative fit testing by temporarily converting the respirator user's actual facepiece into a negative pressure respirator with appropriate filters. You also may use an identical negative pressure air-purifying respirator facepiece with the same sealing surfaces as a surrogate for the atmosphere-supplying or powered air-purifying respirator facepiece.

Accomplish quantitative fit testing by modifying the facepiece to allow sampling inside the facepiece in the breathing zone of the user, midway between the nose and mouth. Do this by installing a permanent sampling probe onto a surrogate facepiece, or by using a sampling adapter designed to temporarily provide a means of sampling air from inside the facepiece.

Remove any modifications to the respirator facepiece for fit testing, and restore the facepiece to NIOSH-approved configuration before using that facepiece in the workplace.

Use of respirators

Employers must establish and implement procedures for the proper use of respirators. These include prohibiting conditions that may result in facepiece seal leakage; preventing employees from removing respirators in hazardous environments; taking actions to ensure continued effective respirator operations throughout the work shift; and establishing procedures for the use of respirators in IDLH atmospheres or in interior structural firefighting situations.

Facepiece seal protection

The revised respiratory protection standard excludes employees with a condition that interferes with the face-to-facepiece seal or valve function of tight-fitting respirators from wearing this type of respirator. In other words, when an employee puts on the respirator, if there are any gaps between the employee's face and the respirator, employers must not permit employees to wear the respirator.

No longer is it just a matter of excluding beard wearers from using tight-fitting respirators. Any facial

hair that comes between the sealing surface of the facepiece and the face or that interferes with valve function will affect the seal. This includes stubble beard growth, beard, mustache or sideburns that-cross the respirator sealing service.

If an employee wears corrective glasses, goggles or other personal protective equipment, the employer has to ensure the employee hears the equipment so it does not interfere with the seal of the facepiece to the user's face. For all tight-fitting respirators, the employer ensures employees perform a user seal check each time they put on the respirator using the procedures in Appendix B-1 or procedures recommended by the respirator manufacturer that the employer demonstrates are as effective as those in Appendix B-1 of the standard.

Continuing respirator effectiveness

Maintain appropriate surveillance of work area conditions and the degree of employee exposure or stress. When there is a change in work area conditions or degree of employee exposure or stress that may affect respirator effectiveness, employers re-evaluate the respirator's continued effectiveness.

The employer ensures that employees leave the respirator use area:

- To wash their faces and respirator facepieces as necessary to prevent eye or skin irritation associated with respirator use;
- If they detect vapor or gas breakthrough changes in breathing resistance or leakage of the facepiece;
- To replace the respirator or the filter, cartridge or canister elements.

If the employee detects vapor or gas breakthrough, changes in breathing resistance or leakage of the facepiece, the employer must replace or repair the respirator before allowing the employee to return to the work area.

Procedures for IDLH atmospheres

For all IDLH atmospheres, the employer ensures that:

- One employee or, when needed, more than one employee is located outside the IDLH atmosphere;
- Visual, voice or signal line communication is maintained between the employee(s) in the IDLH atmosphere and the employee(s) located outside the IDLH atmosphere;
- The employee(s) located outside the IDLH atmosphere are trained and equipped to provide effective emergency rescue;
- The employer or designee is notified before the employee(s) located outside the IDLH atmosphere enter the IDLH atmosphere to provide emergency rescue;
- The employer or designee authorized to do so by the employer, once notified, provides necessary assistance appropriate to the situation;
- Employee(s) located outside the IDLH atmospheres are equipped with:
- Pressure demand or other positive pressure SCBAs, or a pressure demand or other positive pressure supplied-air respirator with auxiliary SCBA; and either
- Appropriate retrieval equipment for removing the employee(s) who enter(s) these hazardous atmospheres if the equipment would contribute to the rescue of the employee(s) and not increase the overall risk resulting from entry; or
- Equivalent means for rescue where retrieval equipment is not required in the previous item.

See section (g)(4) of the standard for special firefighting requirements.

Cleaning and disinfecting

Employers provide each respirator user with a clean, sanitary respirator in good working order. They ensure that respirators are cleaned and disinfected using the procedures in Appendix B-2 of the standard, or procedures recommended by the respirator manufacturer, if these procedures are equally effective. Clean the respirators and disinfect at the following intervals:

- Clean and disinfect respirators issued for the exclusive use of an employee as often as necessary to maintain sanitary condition;
- Clean and disinfect respirators issued to more than one employee before being worn by different individuals;
- Clean and disinfect respirators maintained for emergency use after each use;
- Clean and disinfect respirators used in fit testing and training after each use.

Storage

The employer ensures to store respirators as follows:

- To protect them from damage, contamination, dust, sunlight, extreme temperatures, excessive moisture and damaging chemicals, and packed or stored to prevent deformation of the facepiece and exhalation valve.

In addition, emergency respirators are:

- Kept accessible to the work area;
- Stored in compartments or in covers clearly marked as containing emergency respirators;
- Stored in accordance with any applicable manufacturer instructions.

Inspection

The employer ensures to:

- Inspect all respirators used in routine situations before each use and during cleaning;
- Inspect all respirators maintained for use in emergency situations at least monthly and in accordance with the manufacturer's recommendations, and checked for proper function before and after each use.
- Inspect emergency escape-only respirators before employees carry them into the workplace for use.

The employer ensures that respirator inspections include:

- A check of respirator function, tightness of connections and the condition of the various parts, including the facepiece, head straps, valves, connecting tube, and cartridges, canisters or filters;
- A check of elastomeric parts for pliability and signs of deterioration.

In addition, inspect SCBAs monthly. Air and oxygen cylinders must be maintained in a fully charged state and recharged when the pressure falls to 90 percent of the manufacturer's recommended pressure level. The employer determines the regulator and warning devices function properly.

For respirators maintained for emergency use, the employer:

- Certifies the respirator by documenting the date of the inspection, the name (or signature) of the person who made the inspection, the findings, required remedial action and a serial number or other means of identifying the inspected respirator;
- Provides this information on a tag or label attached to the storage compartment for the respirator. The employer keeps this information with the respirator or includes it in inspection reports stored as paper or electronic files. Maintain this information until replaced following a subsequent certification.

Repairs

The employer ensures that respirators that fail an inspection or are otherwise defective are removed from service, and are discarded, repaired or adjusted in accordance with the following procedures:

- Persons appropriately trained to perform such operations repairs or adjusts respirators. Use only the respirator manufacturer's NIOSH-approved parts designed for the respirator;
- Make repairs according to the manufacturer's recommendations and specifications for the type and extent of repairs to be performed;
- Have the manufacturer or a technician trained by the manufacturer, adjust or repair reducing and admission valves, regulators and alarms.

Breathing air quality and use

Employers must provide employees using atmosphere-supplying respirators (supplied-air and SCBA) with breathing gases of high purity. The employer ensures compressed air, compressed oxygen, liquid air and liquid oxygen used for respiration accords with the following specifications:

- Compressed and liquid oxygen meets the United States Pharmacopoeia requirements for medical or breathing oxygen;
- Compressed breathing air meets at least the requirements for Grade D breathing air described in the American National Standards Institute's (ANSI's)/Compressed Gas Association Commodity Specification for Air, G-7.1-1989, to include:
- Oxygen content (v/v) of 19.5-23.5 percent;
- Hydrocarbon (condensed) content of 5 milligrams per cubic meter of air or less;
- Carbon monoxide content of 10 ppm or less;
- Carbon dioxide content of 1,000 ppm or less;
- Lack of noticeable odor.

The employer ensures compressed oxygen is not used in atmosphere-supplying respirators that have previously used compressed air. The employer ensures oxygen concentrations greater than 23.5 percent are used only in equipment designed for oxygen service or distribution.

The employer ensures cylinders used to supply breathing air to respirators meet the following requirements:

- Cylinders are tested and maintained as prescribed in the Shipping Container Specification Regulations of the Department of Transportation (49 CFR part 173 and part 178);
- Cylinders of purchased breathing air have a certificate of analysis from the supplier that the breathing air meets the requirements for Grade D breathing air;
- The moisture content in the cylinder does not exceed a dew point of -50 degrees. F (-45.6 degrees. C) at 1 atmosphere pressure.

The employer ensures that compressors used to supply breathing air to respirators are constructed and situated so as to:

- Prevent entry of contaminated air into the air-supply system;
- Minimize moisture content so that the dew point at 1 atmosphere pressure is 10 degrees F (5.56 degrees. C) below the ambient temperature;
- Have suitable in-line air-purifying sorbent beds and filters to further ensure breathing air quality. Sorbent beds and filters are maintained and replaced or refurbished periodically following the manufacturer's instructions;
- Have a tag containing the most recent change date and the signature of the person authorized by the employer to perform the change. Maintain the tag at the compressor.

For compressors that are not oil-lubricated, the employer ensures carbon monoxide levels in the breathing air do not exceed 10 ppm.

For oil-lubricated compressors, the employer uses a high-temperature or carbon monoxide alarm, or both, to monitor carbon monoxide levels. If using only high-temperature alarms, moniter supply at intervals sufficient to prevent carbon monoxide in the breathing air from exceeding 10 ppm.

The employer ensures breathing air couplings are incompatible with outlets for nonrespirable worksite air or other gas systems. Do not introduce any asphyxiating substance into breathing air lines.

The employer uses breathing gas containers marked in accordance with the NIOSH respirator certification standard, 42 CFR part 84.

Identification of filters, cartridges and canisters

The employer ensures all filters, cartridges and canisters used in the workplace are labeled and color coded with the NIOSH approval label. He or she ensures the label is not removed and remains legible.

Training and Information

The employer must provide effective training to employees required to use respirators. The training must be comprehensive, understandable and recur annually, and more often if necessary. The employer is also to provide the basic information

on respirators in Appendix D to employees who wear respirators when not required by this section or by the employer.

The employer ensures each employee can demonstrate knowledge of at least:

- Why the respirator is necessary and how improper fit, usage or maintenance can compromise the respirator's protective effect;
- The limitations and capabilities of the respirator;
- How to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions;
- How to inspect, put on and remove, use and check the respirator's seals;
- The procedures for maintenance and storage of the respirator;
- How to recognize medical signs and symptoms that may limit or prevent the effective use of respirators;
- The general requirements of this section.

Conduct the training so employees understand the material. The employer provides training prior to requiring the employee to use a respirator in the work place. An employer that can demonstrate that a new employee has received training within the last 12 months that addresses the elements mentioned previously is not required to repeat such training provided the employee can demonstrate knowledge of those element(s). Previous training not repeated initially by the employer must be provided no later than 12 months from the date of the previous training.

Retraining is administered annually and when:

- Changes in the workplace or the type of respirator render previous training obsolete;
- Inadequacies in the employee's knowledge or use of the respirator indicate the employee has not retained the requisite understanding or skill;
- Any other situation arises in which retraining appears necessary to ensure safe respirator use.

The employer provides the basic advisory information on respirators, as presented in Appendix D, in any written or oral format to employees who wear respirators when the standard or the employer do not require such use.

Program evaluation

Employers must to conduct work place evaluations as necessary to ensure proper implementation of the written respiratory protection program and employees' proper use of respirators. Factors to assess include:

- Respirator fit, including the ability to use the respirator without interfering with effective work place performance;
- Appropriate respirator selection for the hazards to which the employee is exposed;
- Proper respirator use under the work place conditions the employee encounters;
- Proper respirator maintenance.

Recordkeeping

Employers must establish and retain written information regarding:

- Medical evaluations — Employers must retain and make available records of required medical evaluations in accordance with 29 CFR 1910.1020;
- Fit testing — Employers must establish a QLFT and QNFT fit tests administered to employees, including: name or identification of the employee tested; type of fit test performed; specific make, model, style, and size of respirator tested; date of test; and pass/fail results for QLFTs; fit factor and strip chart recording or other recording of the test results for QNFTs. Retain fit test records for respirator users until administering the next fit test;
- The written respirator program — This information will facilitate employee involvement in the respirator program, assist employers in auditing the program's adequacy and provide a record for compliance determinations by OSHA. Employers must retain a written copy of the current respirator program. Make written materials required to be retained available upon request to affected employees and to the Assistant Secretary U. S. DOL/OSHA or designee for examination and copying.

Appendix D to Sec. 1910.134 (Mandatory) Information for Employees Using Respirators When Not Required Under the Standard Respirators are an

effective method of protection against designated hazards when properly selected and worn. Respirator use is encouraged, even when exposures are below the exposure limit, to provide an additional level of comfort and protection for workers.

However, if a respirator is used improperly or not kept clean, the respirator itself can become a hazard to the worker. Sometimes, workers may wear respirators to avoid exposures to hazards, even if the amount of hazardous substance does not exceed the limits set by OSHA standards. If your employer provides respirators for your voluntary use, or if you provide your own respirator, you need to take certain precautions to be sure that the respirator itself does not present a hazard.

You should do the following:

- Read and heed all instructions provided by the manufacturer on use, maintenance, cleaning and care, and warnings regarding the respirator's limitations;
- Choose respirators certified for use to protect against the contaminant of concern;
- Do not wear your respirator into atmospheres containing contaminants for which your respirator is not designed to protect against. For example, a respirator designed to filter dust particles will not protect you against gases, vapors or very small solid particles of fumes or smoke.
- Keep track of your respirator so that you do not mistakenly use someone else's respirator.

NIOSH certifies respirators. A label or statement of certification should appear on the respirator or respirator packaging. It will tell you what the respirator is designed for and how much it will protect you.