Industry Guide 44

A Guide to Respiratory Protection

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This edition of A Guide to Respiratory Protection is based on information published by the U.S. Occupational Safety and Health Administration and the National Institute for Occupational Safety and Health. This guide was originally compiled by J. Edgar Geddie, Ph.D., health standards officer. The information in this guide was updated in 2012.

This guide is intended to be consistent with all existing OSHA standards; therefore, if an area is considered by the reader to be inconsistent with a standard, then the OSHA standard must be followed instead of this guide. Additional information about respirators and respiratory protection programs can be accessed through the A–Z Safety and Health Topics on the N.C. Department of Labor's Internet site.

To obtain additional copies of this guide, or if you have questions about North Carolina occupational safety and health standards or rules, please contact:

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Additional sources of information are listed on the inside back cover of this guide.

The projected cost of the NCDOL OSH program for federal fiscal year 2011–2012 is $17,841,216. Federal funding provides approximately 31 percent ($5,501,500) of this total.

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Contents

Foreword

The term respirator invokes several images. One of these is that of a single strap dust mask similar to those sold in almost any hardware or home improvement store. Another is that of the gas masks worn by military personnel during combat or anti-terrorist activities. Lastly, the term respirator may conjure up the image of a fire fighter wearing a self-contained breathing apparatus (SCBA) rushing into a burning building. Regardless of the type of respirator worn, if it is not properly used it can have detrimental health effects for the user. These health effects can range from slight irritation of the throat and lungs to illness or, in the worst case, death.

A Guide to Respiratory Protection examines the types of respirators available and the elements of an effective respiratory protection standard that are required by the NCDOL OSHA respiratory protection standard, 29 CFR 1910.134. Particular attention is given to selection, medical evaluation, fit testing and training.

In North Carolina, the N.C. Department of Labor enforces the federal Occupational Safety and Health Act through a state plan approved by the U.S. Department of Labor. NCDOL offers many educational programs to the public and produces publications to help inform people about their rights and responsibilities regarding occupational safety and health.

When reading this guide, please remember the mission of the N.C. Department of Labor is greater than just regulatory enforcement. An equally important goal is to help citizens find ways to create safe workplaces. Everyone profits when managers and employees work together for safety. This booklet, like the other educational materials produced by the N.C. Department of Labor, can help.

Cherie Berry
Commissioner of Labor

Introduction

In industry, respirators are often viewed as a quick fix for protecting employees against overexposures to airborne contaminants when existing ventilation is inadequate. However, there are limitations on the use of respirators that, if exceeded, can subject employees to serious or fatal health consequences.

Respirators have been used throughout history as early as ancient Roman times. Mention of their use appears in reports of industrial processes during the Middle Ages.[1] Early respirators consisted of animal bladders and animal blankets or rags wrapped around the nose and mouth. With the 19th century came the development of masks, primarily for fire fighters, that combined aerosol filters and vapor absorbents.

The use of chemical warfare agents in World War I led to the development of respirators by the Bureau of Mines for use by the army. Following the war, the need to protect individuals against the misuse of wartime respirators led to the development of the first United States respirator standards by the Bureau of Mines that governed the approval and use of respirators. Subsequently, the first respirator approval was issued in 1920 for a self-contained breathing apparatus (SCBA). Following this, other federal respiratory protection standards were developed, leading to the present OSHA respiratory protection standard, 29 CFR 1910.134, and to the current certification and approval of respirators by the National Institute for Occupational Safety and Health (NIOSH). These rules were initially promulgated under 30 CFR Part 11 and were later recodified to 42 CFR Part 84.

1. *Patty's Industrial Hygiene and Toxicology*, 4th Edition, John Wiley & Sons, Inc., 1991, pp 675-676 and references therein.

1

Respiratory Hazards in the Workplace

Exposure Assessment

Respiratory protection should never be used either as a primary solution or as the only solution for controlling employee exposure to harmful airborne contaminants. Rather, respirators supplement engineering and administrative controls and work practices when they are not adequate to control worker exposure to airborne contaminants to safe levels.

To identify the appropriate type and level of respiratory protection, employers must conduct an exposure assessment of their workplace. The purpose of this is to identify the types of air contaminants present and the levels of exposure to these substances to select the appropriate respirator when respiratory protection is necessary.

Air contaminants can exist in several forms that are dependent on their identity, how the exposure is generated, and its physical form or state of matter. These include particulates, gases and vapors.

Particulates

Particulates constitute the most common type of air contaminant in occupational settings and include dusts, fibers, mists and fumes. Dusts are generated during the handling, crushing, grinding, detonation, impact and decrepitation (breaking apart by heat) of solid materials and have a general range of particle sizes ranging from 0.1 to 25 micron (1/25,400 inch) diameter. The health consequences of dust exposure by inhalation depend on the dust particle size and the toxicity of the material from which the dust is generated. Some dusts that are known to produce hazardous health effects include those from beryllium, raw cotton, inorganic lead, nickel, cadmium, chromium and silica.

A fiber is a particle that has a length-to-diameter ratio of 3 to 1 or greater. In the workplace, exposure to fibers can arise from asbestos-containing materials and man-made mineral fibers (MMMF, also referred to as synthetic vitreous fibers (SVF)) such as refractory ceramic fibers, fiberglass (glass wool and glass filament) and mineral wool (rockwool and slagwool).[2]

A fume is formed when volatilized particles condense in air during operations such as welding, brazing and torch cutting. Fume particulates generally have a particle diameter that is less than 1 micron. In most cases, the hot vapor reacts with oxygen in air to form the oxide. Examples include iron oxide fume, zinc oxide fume and chromium (VI) oxide.

Mists are suspended liquid droplets generated by the condensation of liquids from vapor back to liquid or by breaking up liquid into a dispersed state, for example, by atomization or splashing. Mists are often found in electroplating and pickling operations.

The size of the particulate determines what part of the respiratory system will be affected. Particles that have a diameter of 10 microns or greater will be deposited in the upper regions of the lungs and will not impact the alveolar (gas exchange) region of the lungs. These are referred to as non-respirable particles. Particulates that are less than 10 microns in diameter are small enough to reach the alveolar sacs of the lungs in great quantities.

With the exception of fibers, the concentration of particulates in air is expressed in terms of milligrams per cubic meter (mg/m3). The measured concentration of airborne fibers, especially for asbestos fibers, is expressed in fibers per cubic centimeter (f/cc).

Gases and Vapors

Vapors are normally in a liquid state at normal temperature and pressure. Vapors can be returned to the liquid state either by lowering the temperature or by increasing the pressure.

2. National Institute for Occupational Safety and Health (NIOSH), *Criteria for a Recommended Standard: Occupational Exposure to Refractory Ceramic Fibers.* DHHS (NIOSH) Publication 2006-123, 2006.

At room temperature and normal pressure, a gas expands to assume the shape and size of the container it occupies. Unlike vapors, gases can be compressed. Additionally they can be returned to a liquid state by lowering the temperature and increasing the pressure.

Gases and vapors, which are measured in units of parts per million (ppm), exert their effects in the alveolar region of the lungs through irritation of surrounding tissue and by absorption directly into the bloodstream. Sampling for gases and vapors in the work environment is done to determine oxygen content, the presence and concentrations of toxic gases, and to identify whether explosive levels of gases exist. For purposes of respiratory protection, only the first two are relative to the use of respirators.

Immediately Dangerous to Life and Health (IDLH)

Special consideration must be given to atmospheric levels of oxygen or toxic substances that are immediately dangerous to life and health (IDLH). The OSHA Respiratory Protection Standard, 29 CFR 1910.134, defines "immediately dangerous to life and health" as an atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

An IDLH atmosphere due to oxygen deficiency is one in which the oxygen concentration is less than 19.5 percent. Where oxygen levels are normal, the concentration of a toxic substance necessary to create an IDLH atmosphere exceeds any regulated or recommended exposure levels and depends upon the specific toxicity of that substance. For example, carbon monoxide has an 8-hour time-weighted average (TWA) permissible exposure limit of 50 ppm and an IDLH concentration of 1,200 ppm (0.12 percent) whereas dimethyl sulfate has an 8-hour TWA permissible exposure limit of 1 ppm—with skin absorption designated as a significant route of exposure—and an IDLH level of 7 ppm.

2

Types of Respirators

What Is a Respirator?

The American Heritage Dictionary defines a respirator as "a screenlike device worn over the mouth or nose or both to protect the respiratory tract."[3] Perhaps a better definition is that from NIOSH, which defines a respirator as "any device designed to provide the wearer with respiratory protection against inhalation of a hazardous atmosphere."[4]

Respirators provide protection either by removing contaminants from the air before it is inhaled or by supplying an independent source of breathable (respirable) air. A respirator that removes contaminants from ambient air is termed an ***air-purifying respirator***. A respirator that provides breathing quality air from an independent source is referred to as an ***atmosphere-supplying respirator***. Each of these categories is further classified according to the type of inlet covering and the mode of operation.

Anatomy of a Respirator

Whether you are considering an air-purifying respirator or a supplied-air respirator, it is important to understand the basic components of a respirator. The *respiratory inlet covering* is that part of a respirator that forms a protective barrier between the user's respiratory tract and an air-purifying device or breathing air source, or both. Depending upon the intended use and the level of protection necessary, the respiratory inlet covering may be a tight-fitting facepiece or a loose-fitting helmet, hood or suit.

The effectiveness of a tight-fitting respirator is dependent upon forming a tight seal between the respirator facepiece and the skin of the respirator user's face. Attached to the facepiece behind the air-purifying device or breathing air source is the *inhalation valve,* which is designed to permit unidirectional (one way) flow of filtered or breathing quality air into the respirator facepiece. Also attached to the facepiece is the *exhalation valve,* which allows exhaled air to leave the facepiece, but does not permit contaminated air to reenter the facepiece.

To help ensure a good seal at all times, tight-fitting facepieces are equipped with adjustable elastomeric straps that are located to permit anchoring around the head and neck of the respirator user.[5] This ensures that the seal with the face of respirator user is not broken as the result of pivoting about a single anchor point. The parts of a tight-fitting respirator are identified in Figure 1a.

By comparison, a loose-fitting respiratory inlet covering (hood or helmet) does not require the formation of seal with the face but must rely on other means to provide respiratory protection. For this reason, loose-fitting inlet coverings are always used in a continuous flow, positive pressure mode of operation as shown in Figures 1b and 2.

3. The American Heritage Dictionary, Second College Edition

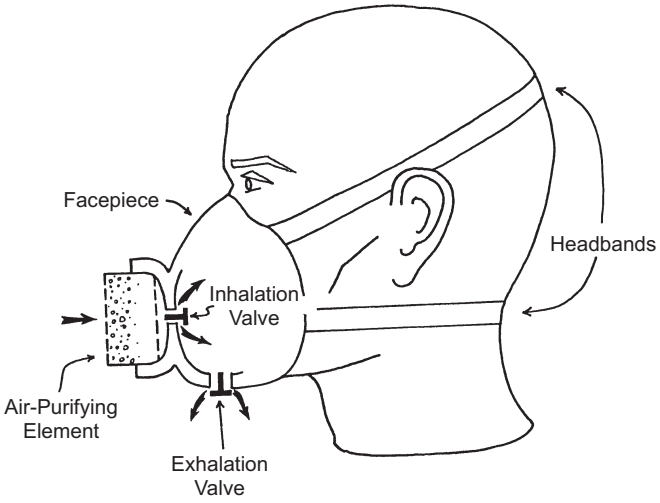
4. 42 CFR Part 84

5. As of the date of this publication there is at least one N95 adjustable single strap respirator approved by NIOSH.

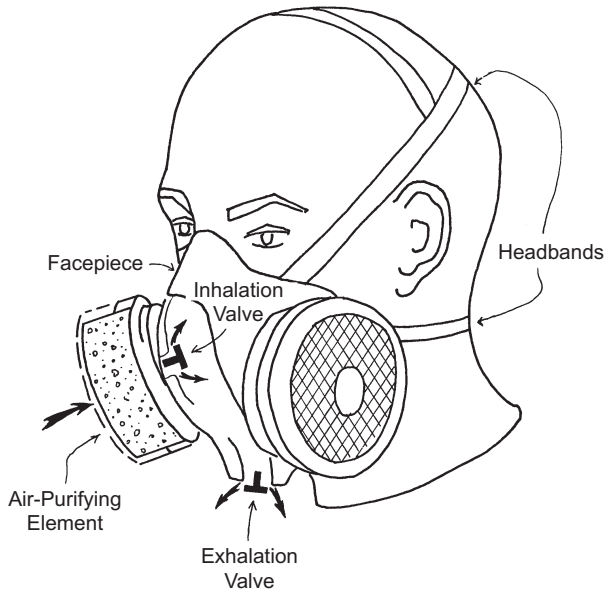
Figure 1a

Tight-Fitting Air-Purifying Respiratory Inlet Coverings

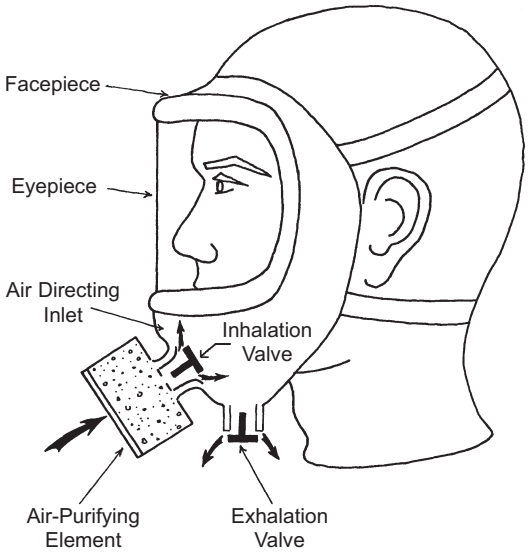
(Courtesy of OSHA)



Typical Quarter-Mask Respirator



Typical Half-Mask Respirator



Typical Full-Facepiece Respirator

Figure 1b

Loose-Fitting Air-Purifying Respiratory Inlet Covering Attached to Motor/Blower Assembly

(Courtesy of OSHA)

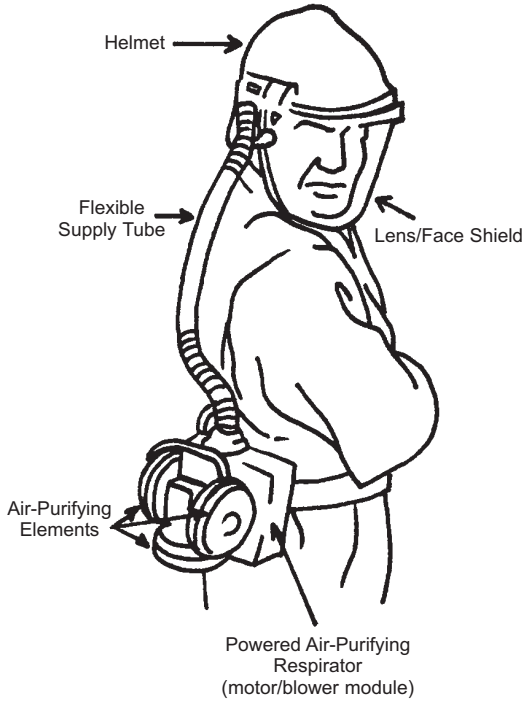
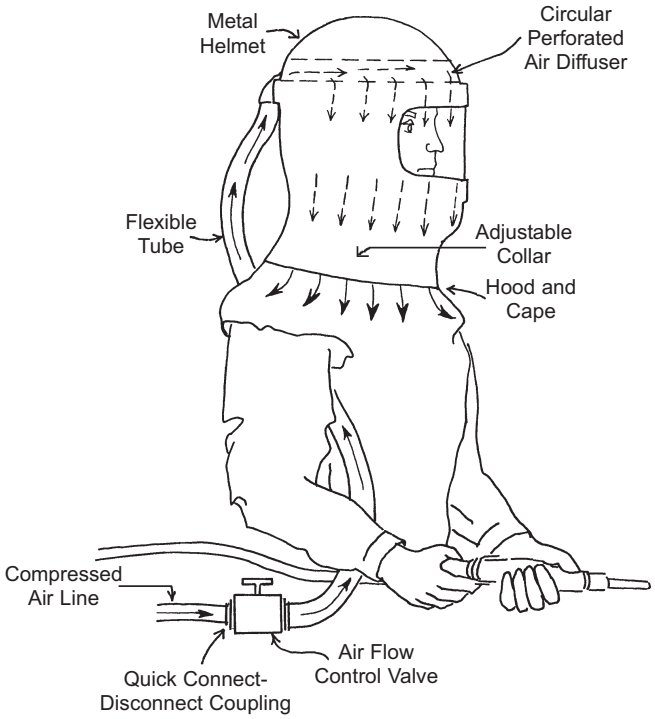


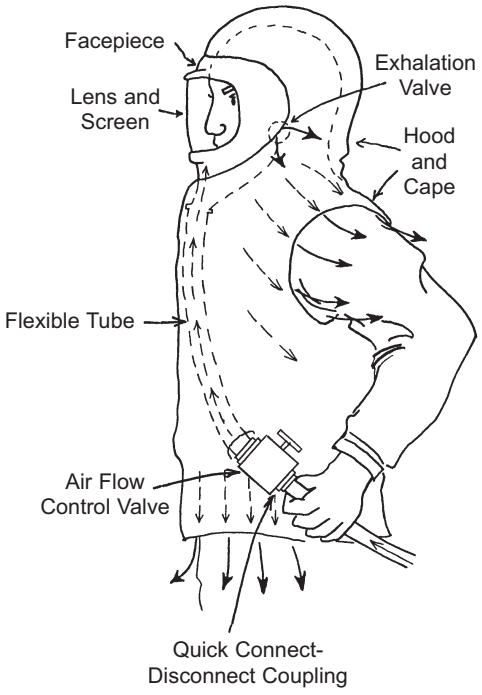
Figure 2

Loose-Fitting Supplied Air Respirators

(Courtesy of OSHA)



Abrasive Blasting Respirator (Hood Respirator)



Loose-Fitting Hood with Blouse Respirator

Air-Purifying Respirators

There are three kinds of air-purifying respirator filtering elements based on the type of filtering medium used. Particulate (particle-removing) respirators are designed to capture particles such as dusts (including fibers), mists and fumes. They do not protect against gases and vapors. Respirators used to protect against gases and vapors are outfitted with cartridges or canisters that filter out and trap specific types of gases or vapors. However, they are not designed to protect against particles. Finally, respirators equipped with combination cartridges are used where both particles and gases or vapors may be present.

Negative-Pressure Air-Purifying Respirators

Air-purifying respirators (APR) can filter ambient air either in a negative pressure or a positive pressure mode of operation. In the negative pressure mode, air is drawn into the respirator facepiece through an appropriate filtering medium (cartridge or canister) during inhalation. A filtering facepiece ("dust mask") respirator is a special type of negative pressure, air-purifying respirator in which most or all of the facepiece is the filtering medium. Examples of negative pressure, air-purifying respirators are shown in Figure 3.

Figure 3

Examples of Air-Purifying Respirators
(Photos courtesy of OSHA)

Filtering facepiece ("dustmask")

Elastomeric half-face cartridge respirator

Elastomeric full-face cartridge respirator

Positive-Pressure, Air-Purifying Respirators

In the positive-pressure mode, ambient air is drawn through the filtering medium using a portable, battery-powered air pump that blows filtered air into the respiratory facepiece. A positive-pressure air-purifying respirator—also known as a powered air-purifying respirators (PAPR)—is further categorized according to whether the facepiece is loose fitting or tight fitting.

A loose-fitting PAPR can accommodate facial hair, but provides less protection to the wearer than a PAPR that has a tight-fitting facepiece. Respiratory inlet coverings for loose-fitting PAPRs include loose-fitting hoods and helmets. Figure 4 shows examples of tight-fitting and loose-fitting PAPRs.

Figure 4

Powered Air-Purifying Respirators
(Photo courtesy of OSHA)

Tight-Fitting Respirator Facepieces

Tight-fitting air-purifying respirators are available with half-face or full-face respirator facepieces. Half-face respirator facepieces cover only the mouth and nose and provide a lower level of protection compared to a full-face facepiece that covers the nose, mouth, and the eyes and face. A full-face respirator is especially useful under conditions where air contaminants are present that can cause eye irritation.

Limitations of Air-Purifying Respirators

Caution! Do not use an air-purifying respirator in an IDLH atmosphere. Because an air-purifying respirator filters ambient air, it does not protect the wearer against an oxygen-deficient atmosphere. In addition, an APR offers minimal or no protection when levels of air contaminants exceed the rated capacities (maximum use concentration, MUC) of particulate filters, cartridges or canisters.

Atmosphere-Supplying (Supplied-Air) Respirators

Respirators that are atmosphere supplying, also known as supplied-air respirators (SAR), use an independent source of breathing quality air provided through a hose connected to the respirator facepiece. The source of breathing air can be supplied from either a compressed air cylinder or an air compressor designed to provide breathing grade air. (Breathing air quality is discussed in Section 9 of this industry guide.)

As with PAPRs, the respirator facepiece for supplied air respirators can be loose-fitting or tight fitting, depending upon the application for which it is worn and the level of protection necessary. Supplied-air respirators that are equipped with loose-fitting respiratory inlet coverings (facepieces) can accommodate facial hair and can be used for a number of applications, including abrasive blasting,[6] but provide less respiratory protection than a tight-fitting facepiece.

6. Respirators used for protection during abrasive blasting operations must be approved by NIOSH for that purpose.

Tight fitting, supplied-air respirators are categorized according to the mode of operation by which breathing air is supplied to the facepiece. A supplied-air respirator operating in a continuous flow mode has a constant flow of breathing air forced into the facepiece. In the demand mode, air is supplied to the facepiece when the user inhales, whereas a respirator operating in a pressure demand mode always maintains a static positive pressure in the facepiece and provides additional air to the wearer when he or she inhales.

Although atmosphere-supplying respirators do not rely on ambient air for respiratory protection, they are not all suitable—or approved—for use in an IDLH atmosphere. Obviously, those equipped with loose-fitting facepieces cannot be used in such an environment. However, among SARs equipped with tight-fitting facepieces, only those that operate in a pressure-demand mode and are equipped with a self-contained air supply, either as a primary or auxiliary air source, can be used. An airline respirator that does not have auxiliary self-contained air can only be used under non-IDLH conditions.

Another type of supplied-air respirator is the self-contained breathing apparatus (SCBA) in which the user carries the air supply, which is an air cylinder. Unlike other supplied-air respirators, a SCBA has the advantage of unlimited mobility for the user because there is no air hose of a fixed length to limit how far the user can travel. A major disadvantage of the SCBA is the fact that the air supply has a limited duration and may, therefore, have to be refilled or replaced before the user has completed the task.

Examples of supplied-air respirators for non-IDLH and IDLH environments are shown in Figure 5.

Figure 5

Supplied-Air Respirators (SAR)
(Photos courtesy of OSHA)

This unit is attached directly to the air source and is approved for use only in non-IDLH atmospheres.

Combination full face, pressure-demand supplied-air respirator with an auxiliary SCBA air supply. This unit can be used in IDLH atmospheres.

3

Elements of a Respiratory Protection Program

An effective respiratory protection program requires the following elements to be in place:

- ❖ Selection of an appropriate respirator;
- ❖ Medical evaluation of the respirator users;
- ❖ Fit testing of tight-fitting respirators;
- ❖ Use of respirators in routine and foreseeable emergency situations;
- ❖ Procedures and schedules for respirator cleaning, disinfecting, storing, inspecting and repairing
- ❖ Training employees in respiratory hazards and appropriate respirator use; and
- ❖ Evaluation of respiratory protection program.

Respiratory Protection Program Administrator

To ensure that all the elements of the respiratory protection program are in place and properly implemented, the employer must designate a respiratory protection program administrator. This individual is responsible for running the program and evaluating its effectiveness in the workplace. An individual is qualified to be a program administrator if he or she has appropriate training or experience in accord with the program's level of complexity. Ultimately, the appropriate qualifications for your program administrator must be determined based on the particular respiratory hazards that exist, or that are reasonably anticipated, at your workplace.

What Level of Training Is Required for the Program Administrator?

This training or experience is appropriate if it enables the program administrator to fulfill the minimum standard requirements of recognizing, evaluating and controlling the hazards in your workplace. For example, if your program requires air-supplying respirators for use in immediately dangerous to life or health (IDLH) environments, your program administrator must have training and experience pertaining to the use of this type of equipment. Similarly, if your company does not use air-supplying respirators and no significant respiratory hazards have been identified at your workplace, someone with less sophisticated experience or training might be able to effectively serve in this position.

Can More Than One Person Serve as the Respirator Program Administrator?

Only one person can fulfill the primary responsibilities of running the program, unless your company has more than one worksite. Under that circumstance, you may have a program administrator for each site. Ordinarily, however, the responsibilities cannot be divided among several employees. Requiring an administrator with sole responsibility helps ensure the integrity of the program by maintaining continuous oversight by one person. Nonetheless, the administrator may rely on other employees to help run parts of the respiratory protection program (e.g., fit testing, medical evaluations).

Each of the essential elements of an effective respiratory protection program is discussed in detail in Section 4 through Section 11 that follow.

4

Respirator Selection

The selection of the appropriate respirator depends upon an evaluation of workplace hazards. Some of the factors to consider are:

- Nature of the hazard, and the physical and chemical properties of air contaminants;
- Concentrations of air contaminants;
- Relevant occupational exposure limits;
- Nature of work operation or process;
- Length of time respirator must be worn;
- Work activities and physical/psychological stress;
- Fit testing; and
- Physical characteristics, functional capabilities and limitations of respirators.

Workplace Evaluation

Nature of the Hazard

When determining the type of respirator to use, the nature of the hazard must be considered. Is the atmospheric hazard in the form of a gas, dust, organic vapor, mist or fume? Does an atmospheric hazard exist due to oxygen deficiency? Is the respiratory hazard the result of a combination of these? The answers to these questions will affect respirator selection and the selection of respirator components such as cartridges, canisters and filters. Physical properties include factors such as particle size for dusts and vapor pressure for gases and vapors. The chemical properties of the air contaminant that affect the breakthrough time[7] of respirator cartridges and canisters, and the ability of the filter material to remove, adsorb or absorb the contaminant must also be considered.

Concentrations of Air Contaminants

Sampling and analysis of the workplace air determines the exposure level and thus the level of respiratory protection necessary. The results of air sampling are then compared with occupational exposure levels to determine how much the respirator must reduce employee exposure to be at a safe level.

Relevant Occupational Exposure Limits

Respirators that employers select must be able to reduce employee exposure to air contaminants to or below the relevant occupational exposure limits. Where an air contaminant has a permissible exposure limit (PEL), the respirator must be capable of reducing employee exposure to or below the regulated level when used in conjunction with existing engineering and work practice controls. In the absence of a PEL, the respirator should be capable of lowered worker exposure to or below other recognized occupational exposure limits such as ACGIH (American Conference of Governmental Industrial Hygienists) recommended threshold limit values (TLVs) or NIOSH (National Institute for Occupational Safety and Health) recommended exposure limits (RELs).

Nature of Work Operation or Process

The type of job operation, the amount of mobility necessary to do the job and the kind of tools the employee will have to use will also influence the type of respirator chosen. This is particularly true when supplied-air respirators, which require connection to a clean air source, are used.

7. Breakthrough time. The time following the first and continuous use of a cartridge after which the user of the cartridge could be exposed to a selected concentration of a harmful vapor. This is the consequence of the cartridge being used up. Service life is the breakthrough time with, possibly, a safety factor applied.

Length of Time Respirator Worn

The length of time an employee must wear a respirator during the workshift must be taken into consideration. Breakthrough times for different chemicals vary greatly and depend on the concentrations of air contaminants, patterns of respirator use, and environmental factors such as temperature and humidity. A respirator that provides adequate protection against one chemical may be inadequate for another chemical that has a shorter breakthrough time. Additionally, employees who must wear respirators for longer periods of time may need respirators that impose a less physical burden.

Work Activities and Stress

Heavy work that is physically challenging may affect an employee's ability to wear certain types of respirators. Temperature and humidity in the workplace can also affect the physical and psychological stress associated with wearing a respirator as well as the effectiveness of respirator filters and cartridges.

Fit Testing

Some employees may be unable to achieve an adequate fit with certain respirator models or a particular type of respirator (e.g., half-face air-purifying respirator) so that an alternative respirator model that provides an adequate fit or other type of respirator that provides adequate protection must be used. Therefore, the employer must provide an adequate number of respirator models and sizes from which employees can choose an acceptable respirator that fits correctly.

Physical Characteristics/Functional Capabilities/Limitations of Respirators

The respirators that are selected must not affect the worker's ability to perform the job safely by impairing the worker's vision, hearing, communication and necessary physical movement. For example, airline respirators would not be an appropriate choice for employees who work around moving machinery and must also move about the worksite.

Selection

Taking into account the selection factors discussed in the preceding paragraphs, the employer must select a NIOSH-certified respirator for use against the particular contaminant(s) present. Where NIOSH has not specifically certified any respirator for use against a particular contaminant present in the workplace, the employer must select a NIOSH-certified respirator that has no limitation that prohibits its use for that contaminant. The respirator must be appropriate for the contaminant's physical form and chemical properties and the conditions under which it will be used. The selection and use of all respirators must be done according to the limitations of the NIOSH certification that appears on the NIOSH certification label.

When NIOSH revised its respirator certification procedures in 1995 under Title 42 Part 84 of the Code of Federal Regulations (42 CFR 84), the procedures for testing and approval of particulate respirators were updated and improved. These procedures resulted in the reclassification of particulate respirators into one of three new classes based upon their resistance to oil mist: N (non-oil resistant); R (oil resistant); and P (oil proof). Each of these classes of respirator was further categorized according to their ability to filter particles down to 0.3 micron (0.3 μ) mean aerodynamic diameter: 95 (95 percent); 99 (99 percent); and 100 (99.97 percent). In addition, NIOSH also developed and added a new procedure for testing against bioaerosols.

Assigned Protection Factors

Each type of respirator has an assigned protection factor (APF) that determines how much above the permissible exposure limit for a particular air contaminant that a particular type of respirator can be used. The APF can then be used to determine the maximum use concentration (MUC) of an air contaminant for which a particular respirator can be used. For atmospheres that are not oxygen deficient, comparing the MUC of a given respirator with the immediately dangerous to life and health (IDLH) concentration for each substance present will determine the type of respirator that can be used and the minimum level of protection that it must provide.

For example, the assigned protection factor for a half-face, air-purifying respirator equipped with the appropriate chemical cartridges is 10. If the respirator is used in an environment containing sulfur dioxide, the PEL equals 5 parts per million (5 ppm), and the MUC equals 50 ppm (i.e., 10 x 5 ppm). The IDLH for sulfur dioxide is 100 ppm. Therefore,

since the MUC is less than the IDLH, a half-face air-purifying respirator could be used in an environment containing sulfur dioxide up to an 8-hour averaged concentration of 50 ppm *provided that the concentration would not be expected to exceed the IDLH level at any time.*

Warning System

When selecting an air-purifying respirator for protection against gases and vapors, a system must be in place to protect the respirator user against contaminant breakthrough. The system can be either a respirator equipped with a cartridge/canister that has an end-of-service life indicator (ESLI) certified by NIOSH for the particular contaminant (e.g., mercury), or an established and enforced cartridge/canister change schedule that will ensure that cartridges and canisters are replaced before the end of their service life.

Immediately Dangerous to Life and Health

For atmospheres that are immediately dangerous to life and health, respirators selected must be able to provide the highest level of respiratory protection and reliability. Because these atmospheres are the most dangerous environments in which respirators are used, no respirator failure can be tolerated. Consequently, only the following respirators can be used in an IDLH environment: full face, pressure-demand self-contained breathing apparatus (SCBA) certified for a minimum service life of 30 minutes, or a combination full facepiece pressure-demand supplied-air respirator (SAR) with an auxiliary self-contained air supply.

5

Medical Evaluation

People assigned to tasks that require the use of a respirator must be physically able to perform the work while using the respirator. The benefits of using a respirator must not be overshadowed by any adverse health effects created by its use. Accordingly, employers must ensure that employees are medically fit to tolerate the additional physical and psychological stress imposed by respirator use in addition to the physical stress originating from job and workplace conditions.

Prior to fit testing and subsequent first time use of the respirator in the workplace, each employee must be medically evaluated and found eligible to wear the respirator selected for their use. This must be determined by a physician or other licensed healthcare professional ("PLHCP"). A variety of qualified healthcare providers, in addition to physicians, can perform the medical evaluations provided they are licensed to do so by the state in which they practice.

Medical Questionnaire

In assessing the ability of the employee to use a respirator, the PLHCP must perform a medical evaluation using a medical questionnaire (Appendix C to 1910.134) or provide a medical examination that obtains the same information as the medical questionnaire. The medical questionnaire must be administered confidentially and at a time and place, during normal work hours, that is convenient to the employee. As an alternative, employers are free to provide employees with a medical examination in lieu of the medical questionnaire if they chose to do so, but are not required by the standard to administer a medical examination unless the employee gives a positive response to specific questions on the questionnaire. The questionnaire is in Appendix II of this industry guide in English and Spanish.

Medical Factors and Conditions

The purpose of a medical evaluation program is to determine if employees can tolerate the physiological burden associated with respirator use. This includes the burden imposed by the respirator itself (e.g., its weight and breathing resistance during both normal operation and under conditions of filter, canister, or cartridge overload), musculoskeletal stress (e.g., when wearing a SCBA), limitations on auditory, visual and olfactory sensations, and isolation from the workplace environment. Because certain jobs and workplace conditions that may require a respirator to be used can also impose a physiological burden on the user, the medical evaluation must also consider other factors. These factors include the type and weight of respirator to be worn, the duration and frequency of respirator use, the expected physical work effort, the use of other protective clothing and equipment, and temperature and humidity extremes that may be encountered. This information must be provided to the PLHCP before he or she can make a recommendation regarding the ability of the employee to use a respirator.

The medical evaluation is designed to identify medical conditions that place employees who use respirators at risk of serious medical consequences. Some of the medical conditions that are known to compromise the ability of an employee to tolerate respirator-related, job-related and workplace-related physiological stress include cardiovascular and respiratory diseases (e.g., a history of high blood pressure, angina, heart attack, cardiac arrhythmias, stroke, asthma, chronic bronchitis, emphysema); reduced pulmonary function caused by other factors (e.g., smoking or prior exposure to respiratory hazards); neurological or musculoskeletal disorders (e.g., ringing in the ears, epilepsy, lower back pain); impaired sensory function (e.g., perforated ear drums, reduced or absent ability to smell); and psychological disorders (e.g., claustrophobia and severe anxiety).

Written Medical Opinion

The employer must obtain a written opinion from the PLHCP regarding whether the employee is medically able to wear a respirator. The opinion must identify any limitations on the employee's use of the respirator, as well as the need for any follow-up medical evaluations that are necessary to assist the PLHCP in making a recommendation about respirator use. The employee must also receive a copy of the PLHCP's written opinion.

The employer must provide the employee with a powered-air purifying respirator (PAPR) if information from the medical evaluation indicates that the employee can use a PAPR but not a negative pressure respirator. However, if the PLHCP later determines that the employee is able to wear a negative-pressure respirator, the employer is no longer required to provide a PAPR to that employee.

Additional Medical Evaluations

The respirator standard requires the employer to medically reevaluate an employee under certain circumstances. This required when:

- The employee reports medical signs or symptoms that are related to the employee's ability to use a respirator;
- A PLHCP, supervisor or the respirator program administrator observes that the employee is having a medical problem during respirator use and they inform the employee of their observation;
- Information from the respiratory protection program, including observations made during fit testing and program evaluation, indicates a need for employee reevaluation; or
- A change occurs in workplace conditions (e.g., physical work effort, type of respirator used, protective clothing, temperature) that may result in a substantial increase in the physiological burden placed on an employee.

6

Fit Testing

To provide the level of protection for which tight-fitting respirators are designed, the effectiveness of the seal that the respirator facepiece makes with the user's face must be tested. Respirators that do not properly seal around the face permit contaminated air to enter the respirator facepiece and the employee's respiratory system. To accommodate the variability of face sizes and facial characteristics, a number of manufacturers offer respirator facepieces in several sizes and models.

What Is the Purpose of Fit Testing?

The purpose of fit testing is to ensure that each employee is using the specific make, model, style and size of respirator that is best suited to them. It also provides an opportunity to check on problems with respirator wear and to reinforce training by having wearers review the proper methods for donning and wearing the respirator.

Who Must Do Fit Testing and How Often?

Fit testing is required for all negative- and positive-pressure tight-fitting respirator facepieces. Fit testing must be done before an employee starts wearing a respirator in the work environment, whenever a different respirator facepiece is used, and at least annually thereafter.

How Is a Fit Test Done?

Prior to the actual fit test, the employee must be shown how to properly don (i.e., put on) the respirator. This includes proper positioning of the facepiece on the face, setting strap tension, and determining a proper fit. The employer must then permit the employee to choose a respirator from a sufficient number of modes and sizes so that the employee can find an acceptable and correctly fitting respirator. Once an acceptable respirator has been found, a user seal check must be conducted the purpose of which is to ensure that the respirator has been properly donned and that the inhalation and exhalation valves are properly functioning.

Is There More Than One Type of Fit Testing?

Fit testing may be either done using either a qualitative fit test (QLFT) or quantitative fit test (QNFT) method. The choice of which fit test method to use will depend on the type of respirator and the minimum level of protection needed. Prior to the beginning of the fit test, the employee must be provided with the description of the fit test and the exercises that he or she will be performing during fit testing. The respirator that is to be fit tested must be worn for at least five minutes before the test begins.

The respirator fit test protocols in Appendix A of 29 CFR 1910.134 are mandatory. A brief discussion of each type follows.

Qualitative Fit Testing (QLFT)

Qualitative fit testing involves the introduction of a test, or challenge, agent in the form of a gas, vapor or aerosol into an area around the head of the respirator user. The wearer must then determine whether they can detect the presence of the test agent by odor, taste or nasal irritation. If the wearer can detect the test agent inside the respirator facepiece, the respirator fit in considered inadequate.

There are four qualitative fit test protocols approved in the Respiratory Protection Standard. The isoamyl acetate (IAA) —also known as banana oil—test determines whether a respirator is protecting the user by questioning whether the user can smell the distinctive odor of IAA. The saccharin and Bitrex tests involve substances with very distinctive sweet and bitter tastes, respectively, that should not be detected through an effective respirator. The irritant smoke (e.g., stannic chloride) test involves a substance that elicits an involuntary irritation response in those exposed to it, the most common response being coughing.

Prior to conducting a qualitative fit test using, the worker must undergo a sensitivity test to determine if he or she can taste, smell or react to the test agent. When performing the IAA test, the test protocol requires separate rooms be used for the odor screening and fit tests, and that the rooms be sufficiently ventilated to ensure that there is no detectable odor of IAA prior to conducting the fit test. The purpose of this is to prevent olfactory fatigue among workers being fit tested by preventing a buildup of IAA in the general room air.

Quantitative Fit Testing (QNFT)

In a quantitative fit test, the determination of a satisfactory fit does not depend on the response of the respirator wearer. Rather, the adequacy of the respirator fit is determined numerically by measuring the amount of leakage into the respirator facepiece. The testing can be done by generating a test aerosol (e.g., using corn oil), using an ambient aerosol, or using controlled negative pressure (CNP) to measure the rate of facepiece leakage. Appropriate instrumentation is used to measure and quantify the respirator fit.

Fit Test Exercises

When conducting a QLFT or QNFT fit test, the following test exercises must be performed except when using the CNP method, which has its own exercise regimen:

1. Normal breathing in a normal standing position without talking;
2. Deep breathing in a normal standing position, breathing slowly and deeply, taking precaution not to hyperventilate;
3. Turning the head slowly from side to side, while standing in place, with the employee holding his or her head momentarily at each extreme so that the employee can inhale at each side;
4. Moving the head up and down slowly, while standing in place, inhaling in the up position when looking toward the ceiling;
5. Talking out loud slowly, reading from a prepared text such as the Rainbow Passage, counting backward from 100, or reciting a memorized poem or song;
6. Grimacing by smiling or frowning (only for QNFT testing);
7. Bending at the waist as if to touch toes (jogging in place can be done when the fit test enclosure doesn't permit bending at the waist); and
8. Normal breathing (as described above).

Each test exercise must be done for one minute, except for the grimace exercise which must be performed for 15 seconds. The respirator must not be adjusted once the fit test exercises begin. Any adjustment voids the test and the fit test must be repeated from the beginning.

The employee must perform exercises in the test environment while wearing any applicable safety equipment that may be worn during actual respirator use and that could interfere with respirator fit. If the employee exhibits breathing difficulty during the fit test, he or she must be referred to a physician or other licensed healthcare professional to determine whether the employee can wear a respirator while performing his or her duties.

Retesting

If the employee finds the fit of the respirator unacceptable, he or she must be given a reasonable opportunity to select a different respirator and to be retested. In addition, retesting is required whenever an employee reports, or the employer, PLHCP, supervisor or respirator program administrative observe changes in an employee's physical condition that could affect respirator fit. Such conditions include, but are not limited to, facial scarring, dental changes (e.g., wearing new dentures), cosmetic surgery, or an obvious change in body weight.

7

Use of Respirators in Routine and Foreseeable Emergency Situations

Once the respirator has been properly selected and fitted, it is necessary to ensure that the respirator is used properly in the workplace. The following conditions may compromise the effective use of the respirator and, thereby, jeopardize worker protection:

- Facepiece seal leakage;
- Removing the respirator at the wrong times in a hazardous atmosphere;
- Improperly performing user seal (fit) checks; or
- Not properly repairing defective parts.

In these circumstances, there is a danger that employees may have a false sense of security in feeling that they are protected when, in fact, they are not.

Employers must also be aware of conditions in the work areas where employees use respirators. Employers are required to routinely evaluate workplace conditions, the degree of employee exposure, and physical stress so that they can provide additional or different respirators when necessary. By observing respirator use under actual workplace conditions, employers can note problems such as changes in the respirator fit due to the use of other protective equipment or conditions leading to skin irritation.

Facepiece Seal Protection

Seal of Tight-Fitting Respirators and Valve Function

Employees who have conditions that affect, and thereby compromise, the facepiece-to-face seal cannot be permitted to wear tight-fitting respirators under conditions of required use. Examples of these conditions include:

- Facial hair that interferes with facepiece seal or valve function;
- Absence of normally worn dentures;
- Facial deformities (e.g., scars, deep skin creases, prominent cheekbones); or
- The use of jewelry or headgear that projects under the facepiece seal.

Corrective Glasses or Goggles

Corrective glasses or goggles, or other personal protective equipment must be worn in a way that will not interfere with the seal of the respirator facepiece with the face. Since eye glasses or goggles may interfere with the seal of half-mask, tight-fitting facepiece, a full-face, tight-fitting facepiece should be worn where corrective lenses or eye protection are necessary since corrective lenses can be mounted in a full-face tight-fitting facepiece. Furthermore, the use of a full-face respirator may be more comfortable and less cumbersome than the combination of a half-face respirator worn with chemical goggles.

Please note that contact lenses can be worn with respirators. They do not have the potential to interfere with the seal of a half-mask respirator.

User Seal Check

A user seal check (formerly known as fit check) must be done every time a tight-fitting respirator is put on or adjusted to ensure proper seating of the respirator on the face. The user seal check can be done either as a negative-pressure or positive-pressure check. If an employee fails a fit check, a tight facepiece seal cannot be formed and another respirator facepiece must be selected.

Continuing Respirator Effectiveness

Skin or Eye Irritation

Skin or eye irritation can result from wearing a respirator in hot, humid conditions or in contaminated environments. Such irritation can be distressing to workers, causing them to remove their respirators while still in a contaminated atmosphere or to cease wearing the respirator altogether. Therefore, to prevent skin or eye irritation associated with using a respirator, employers must permit workers to leave the work area to wash their faces and respirator facepieces as needed.

Filter, Canister and Cartridge Elements for Air-Purifying Respirators

Whenever a respirator user detects vapor or gas breakthrough (by odor, taste or irritation effects), experiences a change in breathing resistance or leakage around the facepiece, the worker must be permitted to leave the respirator use area to replace the respirator or the filter, cartridge or canister elements. They must also be allowed to leave the respirator use area when replacing cartridge or canister elements according to a change schedule or when an end-of-service-life indicator shows that the cartridge or canister must be changed.

Repair, Disposal and Replacement of Respirators

Because respirators must be in good working condition to be effective, it is important that they not be used if they are impaired in any way, such as a broken strap, misshaped facepiece or inability to maintain to face seal. Respirators that are not properly functioning must therefore be replaced, repaired or discarded. Replacement parts for elastomeric respirators can be obtained from the manufacturer of the respirator.

Voluntary Use of Respirators

Up to this point, the discussion has focused on the routine use of tight-fitting respirators in situations where workplace conditions cannot control worker exposure to or below established exposure limits, or the employer requires the use of respirators when working in certain processes. In other situations where no potential exists for overexposure to workplace contaminants, employers can permit employees to wear respirators on a voluntary basis for reasons not related to overexposure to airborne contaminants, such as allergies to nuisance dust or plant pollens.

However, employers still maintain some responsibilities to ensure employee health and safety. Where respirator use is not required and employees are allowed to use their own respirators or respirators are provided by the employer, the employer must determine that the use of the respirator will not create a hazard to the employee. A copy of Appendix D ("Information for Employees Using Respirators When Not Required Under the Standard") of the Respiratory Protection Standard must also be provided to the employee. In addition, the employer must establish and implement a written respirator program that addresses the following elements: the medical fitness of the employee to use the respirator; and procedures to ensure that the respirator is cleaned, stored and maintained in such a manner that it will not present a health hazard to the user.

An exception exists when the voluntary use of respirators only involves filtering facepiece (dust mask) respirators. The employer is not required to include their use in a written respiratory protection program. However, the employer is still required to provide each employee who voluntarily uses a filtering facepiece respirator with a copy of Appendix D of the Respiratory Standard. A copy of this appendix is included in Appendix III of this industry guide in English and Spanish.

Immediately Dangerous to Life or Health Atmospheres

Atmospheres are IDLH when they pose an immediate threat to life, would cause irreversible adverse health effects, or would interfere with an individual's ability to escape from a dangerous atmosphere. (IDLH atmospheres are defined in Section 1 of this document.) Care must be exercised in these situations because failure of the respirator to provide adequate protection can result in serious injury or death. Consequently, the employer must develop and implement specific procedures as part of their respiratory protection program regarding the use of respirators in IDLH atmospheres. These procedures must include at least the following provisions:

1. At least one employee (referred to as the "standby employee") must be located outside the IDLH atmosphere and must maintain visual, voice or signal line communication with employee(s) in the IDLH atmosphere;

2. The standby employee(s) located outside the IDLH atmosphere must be trained and equipped to provide effective emergency rescue;
3. The employer or authorized designee is to be notified before the standby employee(s) enter the IDLH atmosphere to provide emergency rescue;
4. The employer or authorized designee, once notified of such entry, must provide the necessary assistance appropriate to the situation;
5. Standby employee(s) must be equipped with pressure demand or other positive pressure SCBA, or a pressure demand or other positive pressure supplied-air respirator with auxiliary SCBA; and
6. Standby employee(s) must be equipped with appropriate retrieval equipment for lifting or removing the employee from the hazardous atmosphere, or, when such retrieval equipment cannot be used because it would increase the overall risk resulting from entry, ensure that equivalent provisions for rescue have been made.

Interior Structural Fire Fighting

Even more hazardous than working in an IDLH atmosphere is interior structural fire fighting. Due to the uncontrollable, unpredictable nature of this type of work, fire fighters must operate using a buddy system. Therefore, additional safeguards must be put in place in addition to those for IDLH atmospheres:

1. Two or more fire fighters must always be sent in together and remain in visual or voice contact with one another at all times;
2. At least two standby personnel must be located outside the fire area; and
3. All personnel engaged in interior structural fire fighting must use SCBA.

The “two in/two out” requirement does not take effect until fire fighters begin to perform interior structural fire fighting. While the fire is in the incipient stage (as determined by the incident commander or other person in charge), or when emergency rescue operations are required before the entire team has assembled, the standard does not require two-member teams inside and outside the structure.

8

Maintenance and Care of Respirators

Employers are required to provide employees using respirators with a respirator that is clean, sanitary and in good working order. These requirements are a vital part of any successful respiratory protection program. To ensure that the respirator remains serviceable and delivers effective protection, a maintenance program must be in place prior to respirator use. As a minimum, the respiratory protection program must contain the following elements of a respirator maintenance program:

- Cleaning and disinfecting procedures;
- Proper storage;
- Regular inspections for defects (including leak check); and
- Repair methods

In addition, the manufacturer's instructions for inspection, cleaning and maintenance should be consulted to ensure that the respirator continues to properly function.

Cleaning and Disinfecting

To prevent skin irritation, dermatitis and to encourage worker acceptance, respirators must be cleaned and sanitized. Buildup of particulate contaminants on the respirator face-to-facepiece seal or on the interior of the facepiece will reduce the protection provided to the respirator user because the contaminant is in the breathing zone or has compromised the ability of the facepiece to form a seal with the face. In addition, it can lead to deterioration of respirator components, thereby reducing the level of protection to the user. Full facepiece respirators must be completely cleaned to ensure that employees can see through the facepiece.

Respirators worn exclusively by an employee must be cleaned and disinfected as often as necessary to be maintained in a sanitary condition. Respirators worn by more than one person must be cleaned and disinfected prior to being used by another individual. Emergency use respirators and respirators used for fit testing must be cleaned and disinfected after each use. The procedures used must be those recommended by the manufacturer or must be at least as effective as the OSHA method for cleaning and disinfecting respirator facepieces—see Appendix I of this industry guide.

Storage

Respirators must be stored to protect them against damage, contamination, dust, sunlight, extreme temperatures, excessive moisture and damaging chemicals. When packed or stored, the facepiece and exhalation valve must be stored in a manner that will prevent warping.

Respirators intended for emergency use must be kept accessible to the work area, but not in an area that might be involved in the emergency, making the respirator inaccessible or resulting it its contamination. Emergency-use respirators must be stored in compartments or covers that are clearly marked to indicate that they contain emergency respirators, and stored according to manufacturer instructions.

Inspection

Respirators must be inspected on a regular basis to ensure their continued reliability. The frequency of inspections depends upon whether the respirator is used or non-emergency, emergency or escape use only. Respirators used in *non-emergency situations* must be inspected before each use and during cleaning. *Emergency use* respirators must be inspected at least monthly and in accordance with the manufacturer's instructions, and checked for proper function before and after each use. *Emergency escape-only* respirators must be inspected before being carried into the workplace.

Inspections of all respirators must include a check of respirator function, tightness of connections, and the conditions of the various parts including, but not limited to, the facepiece, head straps, valves, connecting tube, and cartridges, canisters or filters. In addition, the elastomeric parts must be evaluated for pliability and signs of deterioration.

For SCBAs, which are required to be inspected monthly, the 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. In addition, the regulator and warning devices must be inspected to ensure that they are properly functioning.

Inspections of emergency use respirators must be certified by the person conducting the inspection by documenting the date that the respirator was inspected, the name or signature of the inspection, the findings of the inspection, any required remedial action, and a serial number or other means of identifying the respirator inspected. This information may be provided by one of three means: as a tag or label attached to the respirator storage compartment; is kept with the respirator; or is stored in the form a inspection reports, either in paper or electronic form. This information must be retained until replaced by the next inspection report.

Repair

Respirators that fail to pass inspection or are otherwise defective must be removed from service and discarded, repaired or adjusted. Repairs or adjustments to respirators must be done only by appropriately trained personnel, using only the respirator manufacturer's NIOSH-approved parts that are designed for that respirator. Repairs can only be made according to the manufacturer's recommendations and specifications concerning the type and extent of repairs to be performed.

Respirator components such as reducing and admission valves, regulators and alarms are complex and essential to the safe and proper functioning of the respirator. Therefore, they can only be adjusted and repaired by the manufacturer or by a manufacturer trained technician.

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Breathing Air Quality and Use

Standards and Specifications

Breathing air for atmosphere-supplying respirators must be of high purity, meet quality levels for content, and not exceed certain contaminant levels and moisture requirements. Compressed air, compressed oxygen, liquid air and liquid oxygen used for respiration must meet the following requirements:

- Compressed and liquid oxygen must meet the United States Pharmacopoeia for medical or breathing oxygen.
- Compressed breathing air must meet at least the requirements for Grade D breathing air as described in the ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-1989.

Compressed oxygen must not be used in atmosphere-supplying respirators, including open-circuit SCBAs that have previously used compressed air. This prohibition is intended to prevent fires and explosions that could result if high-pressure oxygen comes into contact with oil or grease that has been introduced to the respirator or the air lines during compressed-air operations. In addition, oxygen in concentrations greater than 23.5 percent can only be used in equipment designed for oxygen service or distribution.

Breathing air may be supplied to respirators from cylinders or air compressors. Where cylinders are used, they must be tested and maintained as prescribed in the Shipping Container Specification Regulations of the Department of Transportation (49 CFR Part 180). Cylinders of purchased breathing air must have a certification of analysis from the supplier stating that the air meets the requirements for Grade D breathing air. In addition, only the respirator manufacturer's NIOSH-approved breathing-gas cylinders may be used.

Breathing Air Compressors

Where compressors are used to supply breathing air, they must be constructed and situated to prevent contaminated air from entering the air supply system. Specifically, the air intake must be located such that exhaust gases from nearby vehicles or from the compressor internal combustion engine, if applicable, or from other exhaust gases ventilated from the work facility cannot enter the compressor air intake.

All compressors must be equipped with suitable in-line, air-purifying sorbent beds and filters to further ensure breathing air quality and to minimize the moisture content so that the dew point at one atmosphere pressure is 10ºF (5.56ºC) below the ambient temperature. Sorbent beds and filters must be maintained and replaced or refurbished periodically according to the manufacturer's instructions. In addition, a tag must be kept at the compressor indicating the most recent change date and the signature of the person authorized by the employer to make the change.

Oil-Lubricated Compressors

Because oil entering the combustion chamber, for example, due to worn piston rings and cylinders, can produce carbon monoxide when ignited, oil-lubricated compressors must be equipped with a high temperature alarm, a carbon monoxide alarm, or both. If only a high temperature alarm is used, the air from the compressor must be tested for carbon monoxide at intervals sufficient to prevent carbon monoxide levels in the breathing air from exceeding 10 parts per million.

Non-Oil Compressors

For compressors that are not oil lubricated, the employer must ensure that carbon monoxide levels do not exceed 10 parts per million. Employers can meet this requirement using several different methods, as appropriate, including the use of continuous carbon monoxide alarms, carbon monoxide sorbent materials, proper air intake location in an area free of contaminants, frequent monitoring of air quality or the use of high temperature alarms and automatic shutoff devices. For example, if the air intake for a breathing air compressor cannot be located in an area that is reliably free of carbon monoxide, the employer may consider combining the use of a carbon monoxide alarm with a carbon monoxide sorbent bed.

Breathing Air Couplings

Breathing air couplings must be incompatible with outlets for non-respirable plant air or other gas systems to prevent accidental servicing of airline respirators with non-respirable gases or oxygen. The accidental coupling of airline respirators with asphyxiant gases, such as argon and nitrogen, has led to the deaths or near death of employees in North Carolina and elsewhere in the United States. The table below identifies some of the businesses involved and a description of the event.

Type of Business	Description of Accident or Fatality
Aluminum foundry	An employee was using an air hammer to chip residues out of a furnace at an aluminum foundry. He was wearing a Bullard (#88 series) air line respirator. Two compressed gas lines with universal access couplings were attached to post #l-5. The one on the right was labeled "natural gas." The one on the left had an old paper tag attached, with the word "air" handwritten on it; however, this line actually contained pure nitrogen. A splitter diverted one part of the gas stream to the air hammer, and the other part of the stream to the airline respirator. The employee was asphyxiated and killed when exposed to pure nitrogen.
Painting contractor	An employee was asphyxiated while working in a spray booth. The employee attached his supplied air respirator to a pure nitrogen supply. The nitrogen supply in the booth was configured with breathing air female fittings compatible with male fittings used with the supplied-air respirator hoses. Due to this configuration, the employee was able to insert the respirator coupling into the nitrogen supply. After breathing pure nitrogen for an unknown period of time, the employee lost consciousness and died.
Painting contractor	An employee plugged his supplied-air respirator into a nitrogen source. He was hospitalized for treatment of asphyxia.
Man-made organic fibers	An employee using a hood respirator and another employee were preparing a batch load of dry chemical powders and crystals for mixing and transfer in the two level engineering polymers mixing facility. One employee left the upper level and began preparing the lower level additives for the mix. When the control room operator noticed that no weight was being added, the lower level employee was instructed to check on the other employee. The lower level employee found the employee wearing the hood respirator down on the floor with a nitrogen gas hose attached to his respirator hood hose. The employee died from asphyxiation.
Painting contractor	Two employees were preparing to perform abrasive blasting work in a second floor spray chamber. They were instructed by the site foreman to don their type CE abrasive blast respirators and upon his return to the area, he found both employees unconscious. The supplied air line for the respirators had been connected to a plant air line labeled "compressed air." After investigating, it was found that the line was 99.998 percent nitrogen. Both employees were hospitalized.
Painting contractor	An employee was using an airline respirator that was connected to a hard pipe nitrogen system. An airline coupler was provided that would have permitted him to connect to the company's breathing air system; however, the coupler was not installed in the employee's breathing airline system. He died from asphyxia.

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Employee Training and Information

One of the key elements in an effective respiratory protection program is employee training. Before employees use a respirator in the workplace, they must receive effective training that covers the purpose, proper use and limitations of respirators used in the workplace. For the training to be effective, it must be comprehensive and presented in a way that employees can understand. In particular, the training should be based upon the employees' educational level and language.

In discussing why the respirator is necessary, the training should also address the identification of the hazards involved. This must also include the extent of employee exposure to those hazards and the potential health effects of such exposures.

Information regarding the consequences of improper fit, usage or maintenance on respirator effectiveness must also be provided to employees. Inadequate attention to any of these program elements would obviously defeat the effectiveness of the respirator. Proper fit, use and maintenance of respirators are critical to employee protection.

Employees must also be provided with an explanation about the amount of protection that the respirators can provide, as well as the limitations of this equipment. Such a discussion should include an explanation about the manner in which the respirator works and how it protects the worker, that is, whether it filters particles, removes vapors or gases from ambient air or supplies clean uncontaminated air for breathing. Where appropriate it should also include limitations on the use of the respirator, such as an explanation about why an air-purifying respirator cannot be used in an IDLH atmosphere.

Employees must know how to use respirators in emergencies, especially those in which the respirator malfunctions. Comprehensive training is necessary where respirators are used in IDLH conditions, including oxygen-deficient atmospheres such as those that occur in fire fighting, rescue operations and confined space entry.

Training must include the procedures about how to inspect the respirator; properly don and remove it; check the fit and respirator seal; and actually wear the respirator. Employees must also be capable of recognizing any problems that may threaten the continued protection provided by the respirator. The training must include identify the steps employees are to follow if they discover any problems during the inspection, that is, who to report the problems to and where they can obtain replacement equipment if necessary.

Instructions must be given to respirator users regarding the proper procedures for maintaining and storing respirators. The extent of this training will vary according to workplace conditions. Where employees are responsible for performing some or all respirator maintenance and for storing respirators when not in use, detailed training in maintenance and storage procedures may be necessary. On other facilities where specific personnel or central repair facilities are assigned to perform these tasks, most employees may only need information about the maintenance and storage procedures without being required to learn detailed technical information.

The training program must also provide employees with sufficient medical information to permit them to recognize the signs and symptoms of any medical conditions that may limit or prevent respirator use. Examples of such medical conditions include shortness of breath and dizziness.

Training must also include the general requirements of the OSHA Respiratory Protection standard, 29 CFR 1910.134. This discussion could simply inform employees of the employer's obligations under the standard to develop and implement a written program, properly select respirators, evaluate respirator use and correct deficiencies, conduct medical evaluations, provide for the proper maintenance, cleaning and storage of respirators, and retain and provide access to specific records.

Training is required for respirator users prior to the first use of a respirator in the workplace and at least annually thereafter. During the annual training, the employee must be able to demonstrate knowledge of the various aspects of respirator use including the capabilities and limitations of the respirator, how to properly put on and remove the respirator, and the other key elements of the respirator program.

Additional training is required when changes in workplace conditions occur or the type of respirator worn render previous training obsolete. Examples of some workplace conditions that might affect respirator use include process changes, increased levels of exposure, and the emergency of new hazards for which the current respirator may not be effective. Additional training might also be necessary when the use of a respirator by an employee indicates a need for retraining.

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Program Evaluation

The employer is required to conduct an evaluation of respirator use in the workplace as often as necessary to make certain that the elements of the respiratory protection program are being put into practice for all employees required to use a respirator. The evaluation will also include an evaluation of the workplace to determine whether the correct respirators are being used and worn properly, and whether employee training about respirator use has been effective.

As part of the program evaluation, employers need to consult with employees about the key issues associated with their use of respirators in the workplace. Among these are whether the respirators are properly fitted; if the wearing of respirators interfere with work performance; whether the respirators are appropriate for the hazards encountered; whether they are worn when necessary; and if they are being properly maintained and stored. Any problems or deficiencies identified by the employer must be promptly corrected.

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Recordkeeping

The Respiratory Protection Standard, 29 CFR 1910.134, requires employers to establish and retain written information regarding medical evaluations, fit testing and the respirator program. This information will assist the employer in auditing the adequacy of the respirator program, encourage employee involvement in the program, and provide a record for compliance determinations by the N.C. Department of Labor, Occupational Safety and Health Division.

A medical evaluation record must be retained for each employee subject to medical evaluation. This record must include the result of the medical questionnaire and, if applicable, a copy of the physician or licensed healthcare professional written opinion and recommendations regarding respirator use, including the results of any relevant medical examinations and tests. Medical evaluation records must be retained and made available as required by 29 CFR 1910.1020, "Access to Employee Exposure and Medical Records."

Fit test records are required to be retained only until the next fit test is conducted. Fit test records must contain the following information:

- Name or identification of the employee tested;
- Type of fit test performed (QNFT, QLFT—irritant smoke, saccharin, Bitrex, etc.);
- Make, model and size of respirator fitted; date of the fit test;
- Pass/fail results (if QLFT is used); or
- Fit factor and strip chart or other record of test results (if QNFT performed)

If an employee discontinues the use of a respirator due to, for example, a change of job duties or effective implementation of engineering controls, fit test records for that employee do not have to be retained. Otherwise, fit test records must be retained to determine whether the employee tested passed the QLFT or passed the QNFT with a fit factor appropriate for the respirator used.

Access to all written materials required to be maintained under the recordkeeping requirements of the Respiratory Protection Standard must be made available for examination and copying. Specifically, the employer must provide access upon request to the employee who is the subject of the records and to the N.C. Department of Labor, Occupational Safety and Health Division.

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Biological Hazards

As stated previously, particulate (particle filtering) respirators are now classified according to their resistance to oil mist and are further categorized based upon how effectively they can filter very small particles, including bioaerosols. Prior to the revision of the respirator certification rules, there was no approved particle respirator for protection against *Mycobacterium tuberculosis* (TB). However, because a HEPA (high-efficiency particulate air) respirator filter met all the necessary criteria for filtering out TB droplet nuclei, which have a particle diameter size between 1 and 5 microns, they were considered to be appropriate for occupational protection against TB.

With the development of bioaerosol testing procedures as part of the new respirator certification rules, NIOSH and CDC (the Centers for Disease Control and Prevention) have determined that an N95 particulate respirator is the *minimum level of respiratory protection* that is effective against occupational exposure to TB. In accordance with the enforcement policy regarding occupational exposure to TB,[8] respirators must be provided to and worn by employees working in five identified occupational settings under any of the following circumstances: when entering rooms housing individuals with suspected or confirmed infectious TB; when present during the performance of high hazard procedures on individuals who have suspected or confirmed infectious TB; and when emergency medical response personnel or others transport, in a closed vehicle, an individual with suspected or confirmed infectious TB.

More recently, the emergence of the 2009 H1N1 influenza virus in pandemic proportions has prompted NIOSH and the CDC to evaluate the effectiveness of surgical masks compared to N95 respirators for health care workers who are treating patients with suspected or confirmed H1N1 disease. As a result, the CDC recommended that fit-tested N95 respirators is the minimum level of respiratory protection be used when health care workers are engaged in aerosol-generating procedures. Accordingly, health care facilities where employees are required to wear N95 tight-fitting respirators must implement a respiratory protection program that complies with the Respiratory Protection Standard, 29 CFR 1910.134, including medical evaluation and fit testing.

8. OSHA Directive CPL 02-02-106, Enforcement Procedures and Scheduling for Occupational Exposure to Tuberculosis, Feb. 9, 1996.

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Standards Having Specific Respirator Selection Requirements and Prohibitions

General Industry

- 1910.94, Ventilation, Abrasive blasting—paragraph (a)(5)
- 1910.1001, Asbestos—paragraph (g)(3)
- 1910.1017, Vinyl chloride—paragraph (g)(3)
- 1910.1018, Inorganic arsenic—paragraph (h)(3)
- 1910.1025, Lead—paragraph (f)(3)
- 1910.1026, Chromium (VI)—paragraph (g)(1)
- 1910.1027, Cadmium—paragraph (g)(3)
- 1910.1028, Benzene—paragraph (g)(3)
- 1910.1029, Coke oven emissions—paragraph (g)(3)
- 1910.1043, Cotton dust—paragraph (f)(3)
- 1910.1044, 1,2-Dibromo-3-chloropropane—paragraph (h)(3)
- 1910.1045, Acrylonitrile—paragraph (h)(3), escape respirators
- 1910.1047, Ethylene oxide—paragraph (g)(3)
- 1910.1048, Formaldehyde—paragraph (g)(3)
- 1910.1050, Methylenedianiline—paragraph (h)(3)
- 1910.1051, 1,3-Butadiene—paragraph (h)(3)
- 1910.1052, Methylene chloride—paragraph (g)(3)

Construction Industry

- 1926.60, Methylenedianiline—paragraph (i)(3)
- 1926.62, Lead in Construction—paragraph (f)(3)
- 1926.1101, Asbestos—paragraph (h)(3)
- 1926.1117, Vinyl chloride (see 1910.1017)
- 1926.1118, Inorganic arsenic (see 1910.1018)
- 1926.1126, Chromium (VI)—paragraph (f)(1)
- 1926.1127, Cadmium—paragraph (g)(3)
- 1926.1128, Benzene (see 1910.1028)
- 1926.1129, Coke oven emissions (see 1910.1029)
- 1926.1144, 1,2-Dibromo-3-chloropropane (see 1910.1044)
- 1926.1145, Acrylonitrile (see 1910.1045)
- 1926.1147, Ethylene oxide (see 1910.1047)
- 1926.1148, Formaldehyde (see 1910.1048)
- 1926.1152, Methylene chloride (see 1910.1052)

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Glossary

Air-purifying respirator. A respirator with an air-purifying filter, cartridge or canister that removes specific air contaminants by passing ambient air through the air-purifying element.

Assigned protection factor (APF). The workplace level of respiratory protection that a respirator or class of respirators is expected to provide to employees when the employer implements a continuing, effective respiratory protection program as specified by the respiratory protection standard.

Canister or cartridge. A container with a filter, sorbent or catalyst, or a combination of these items, that removes specific contaminants from the air passed through the container.

Demand respirator. An atmosphere-supplying respirator that admits breathing air to the facepiece only when a negative pressure is created inside the facepiece by inhalation.

Emergency situation. Any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment that may or does result in an uncontrolled substantial release of an airborne contaminant.

End-of-service-life indicator (ESLI). A system that warns the respirator user of the approach of the end of adequate respiratory protection, for example, that the sorbent is approaching saturation or is no longer effective.

Escape-only respirator. A respirator intended to be used only for emergency exit.

Filtering facepiece (dust mask). A negative-pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium.

Filter or air-purifying element. A component used in respirators to remove solid or liquid aerosols from the inspired (inhaled) air.

Fit factor. A quantitative estimate of the fit of a particular respirator to a specific individual, and typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn.

Fit test. The use of a protocol to qualitatively or quantitatively evaluate the fit or a respirator on an individual. See also *Qualitative fit test (QLFT)* and *Quantitative fit test (QNFT)*.

Helmet. A rigid respiratory inlet covering that also provides head protection against impact and penetration.

High-efficiency particulate air (HEPA) filter. A filter that is at least 99.97 percent efficient in removing monodisperse particles of 0.3 micrometers in diameter and larger. The equivalent NIOSH 42 CFR Part 84 particulate filters are the N100, R100 and P100 filters.

Hood. A respiratory inlet covering that completely covers the head and neck and may also cover portions of the shoulders and torso.

Immediately dangerous to life and health (IDLH). An atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects or would impair an individual's ability to escape from a dangerous atmosphere.

Interior structural fire fighting. The physical activity of fire suppression, rescue or both inside of buildings or enclosed structures that are involved in a fire situation beyond the incipient stage.

Loose-fitting facepiece. A respiratory inlet covering that is designed to form a partial seal with the face.

Maximum use concentration (MUC). The maximum atmospheric concentration of a hazardous substance from which an employee can be expected to be protected when wearing a respirator, and is determined by the assigned protection factor of the respirator or class of respirators and the exposure limit of the hazardous substance. The MUC usually can be determined mathematically by multiplying the assigned protection factor specified for a respirator by the permissible exposure limit (PEL), short-term exposure limit, ceiling limit, peak limit, or any other exposure limit used for the hazardous substance.

Negative-pressure respirator (tight fitting). A respirator in which the air pressure inside the facepiece is negative during inhalation with respect to the ambient air pressure outside the respirator.

Oxygen deficient atmosphere. An atmosphere with an oxygen content below 19.5 percent by volume.

Physician or other licensed health care professional (PLHCP). An individual whose legally permitted scope of practice (i.e., license, registration or certification) allows him or her to independently provide, or be delegated the responsibility to provide, some or all of the health care services required by 29 CFR 1910.134(e), "Medical evaluation."

Positive-pressure respirator. A respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.

Powered air-purifying respirator (PAPR). An air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.

Pressure demand respirator. A positive-pressure atmosphere-supplying respirator that admits breathing air to the facepiece when the positive pressure is reduced inside the facepiece by inhalation.

Qualitative fit test (QLFT). A pass/fail fit test to assess the adequacy of respiratory fit that relies on the individual's response to the test agent.

Quantitative fit test (QNFT). An assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.

Respiratory inlet covering. The portion of a respirator that forms the protective barrier between the user's respiratory tract and an air-purifying device or breathing air source, or both. It may be a facepiece, helmet, hood, suit or a mouthpiece respirator with nose clamp.

Self-contained breathing apparatus (SCBA). An atmosphere-supplying respirator for which the breathing air source is designed to be carrier by the user.

Service life. The period of time that a respirator, filter or sorbent, or other respiratory equipment provides adequate protection to the wearer.

Supplied-air respirator (SAR) or airline respirator. An atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user.

Tight-fitting facepiece. A respiratory inlet covering that forms a complete seal with the face.

User seal check. An action conducted by the respirator user to determine if the respirator is properly seated on the face.

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References

1. Occupational Safety and Health Administration (OSHA). Technical Manual (OTM), TED 01-00-015, Section VIII, Chapter 2 (Respiratory Protection). 1999.

2. OSHA. *Small Entity Compliance Guide for the Revised Respiratory Protection Standard.* 1998. Available: www.osha.gov/Publications/SECG_RPS/secgrev-current.pdf

3. U.S. Department of Labor, OSHA, *Federal Register.* Volume 63, Pages 1152-1300. Respiratory Protection: Final Rule, January 8, 1998.

Appendix I

Respirator Cleaning Procedures (29 CFR 1910.134 Appendix B-2)—Mandatory

These procedures are provided for employer use when cleaning respirators. They are general in nature, and the employer as an alternative may use the cleaning recommendations provided by the manufacturer of the respirators used by their employees, provided such procedures are as effective as those listed here in Appendix B-2. Equivalent effectiveness simply means that the procedures used must accomplish the objectives set forth in Appendix B-2, i.e., must ensure that the respirator is properly cleaned and disinfected in a manner that prevents damage to the respirator and does not cause harm to the user.

I. Procedures for Cleaning Respirators

A. Remove filters, cartridges, or canisters. Disassemble facepieces by removing speaking diaphragms, demand and pressure-demand valve assemblies, hoses, or any components recommended by the manufacturer. Discard or repair any defective parts.

B. Wash components in warm (43°C [110°F] maximum) water with a mild detergent or with a cleaner recommended by the manufacturer. A stiff bristle (not wire) brush may be used to facilitate the removal of dirt.

C. Rinse components thoroughly in clean, warm (43°C [110°F] maximum), preferably running water. Drain.

D. When the cleaner used does not contain a disinfecting agent, respirator components should be immersed for two minutes in one of the following:

1. Hypochlorite solution (50 ppm of chlorine) made by adding approximately one milliliter of laundry bleach to one liter of water at 43°C (110°F); or,

2. Aqueous solution of iodine (50 ppm iodine) made by adding approximately 0.8 milliliters of tincture of iodine (6–8 grams ammonium and/or potassium iodide/100 cc of 45 percent alcohol) to one liter of water at 43°C (110°F); or,

3. Other commercially available cleansers of equivalent disinfectant quality when used as directed, if their use is recommended or approved by the respirator manufacturer.

E. Rinse components thoroughly in clean, warm (43°C [110°F] maximum), preferably running water. Drain. The importance of thorough rinsing cannot be overemphasized. Detergents or disinfectants that dry on facepieces may result in dermatitis. In addition, some disinfectants may cause deterioration of rubber or corrosion of metal parts if not completely removed.

F. Components should be hand-dried with a clean lint-free cloth or air-dried.

G. Reassemble facepiece, replacing filters, cartridges, and canisters where necessary.

H. Test the respirator to ensure that all components work properly.

Appendix II

Medical Questionnaires (English & Spanish)

The medical questionnaires in Appendix C of the Respiratory Protection Standard are mandatory.

29 CFR 1910.134 Appendix C
Respirator Medical Evaluation Questionnaire

To the employer: Answers to questions in Section 1, and to question 9 in Section 2 of Part A, do not require a medical examination.

To the employee: Can you read (circle one): Yes/No

Your employer must allow you to answer this questionnaire during normal working hours, or at a time and place that is convenient to you. To maintain your confidentiality, your employer or supervisor must not look at or review your answers, and your employer must tell you how to deliver or send this questionnaire to the health care professional who will review it.

Part A. Section 1. (Mandatory): The following information must be provided by every employee who has been selected to use any type of respirator (please print).

1. Today's date:_____
2. Your name:_____
3. Your age (to nearest year):_____
4. Sex (circle one): Male/Female
5. Your height: _____ ft. _____ in.
6. Your weight: _____ lbs.
7. Your job title:_____
8. A phone number where you can be reached by the health care professional who reviews this questionnaire (include the Area Code): _____
9. The best time to phone you at this number: _____
10. Has your employer told you how to contact the health care professional who will review this questionnaire (circle one): Yes/No
11. Check the type of respirator you will use (you can check more than one category):
    a. _____ N, R, or P disposable respirator (filter-mask, non-cartridge type only).
    b. _____ Other type (for example, half- or full-facepiece type, powered-air purifying, supplied-air, self-contained breathing apparatus).
12. Have you worn a respirator (circle one): Yes/No

    If "yes," what type(s):_____

    _____

Part A. Section 2. (Mandatory): Questions 1 through 9 below must be answered by every employee who has been selected to use any type of respirator (please circle "yes" or "no").

1. Do you currently smoke tobacco, or have you smoked tobacco in the last month: Yes/No
2. Have you ever had any of the following conditions?
    a. Seizures: Yes/No
    b. Diabetes (sugar disease): Yes/No
    c. Allergic reactions that interfere with your breathing: Yes/No
    d. Claustrophobia (fear of closed-in places): Yes/No
    e. Trouble smelling odors: Yes/No
3. Have you ever had any of the following pulmonary or lung problems?
    a. Asbestosis: Yes/No
    b. Asthma: Yes/No
    c. Chronic bronchitis: Yes/No

d. Emphysema: Yes/No
e. Pneumonia: Yes/No
f. Tuberculosis: Yes/No
g. Silicosis: Yes/No
h. Pneumothorax (collapsed lung): Yes/No
i. Lung cancer: Yes/No
j. Broken ribs: Yes/No
k. Any chest injuries or surgeries: Yes/No
l. Any other lung problem that you've been told about: Yes/No

4. Do you currently have any of the following symptoms of pulmonary or lung illness?
   a. Shortness of breath: Yes/No
   b. Shortness of breath when walking fast on level ground or walking up a slight hill or incline: Yes/No
   c. Shortness of breath when walking with other people at an ordinary pace on level ground: Yes/No
   d. Have to stop for breath when walking at your own pace on level ground: Yes/No
   e. Shortness of breath when washing or dressing yourself: Yes/No
   f. Shortness of breath that interferes with your job: Yes/No
   g. Coughing that produces phlegm (thick sputum): Yes/No
   h. Coughing that wakes you early in the morning: Yes/No
   i. Coughing that occurs mostly when you are lying down: Yes/No
   j. Coughing up blood in the last month: Yes/No
   k. Wheezing: Yes/No
   l. Wheezing that interferes with your job: Yes/No
   m. Chest pain when you breathe deeply: Yes/No
   n. Any other symptoms that you think may be related to lung problems: Yes/No

5. Have you ever had any of the following cardiovascular or heart problems?
   a. Heart attack: Yes/No
   b. Stroke: Yes/No
   c. Angina: Yes/No
   d. Heart failure: Yes/No
   e. Swelling in your legs or feet (not caused by walking): Yes/No
   f. Heart arrhythmia (heart beating irregularly): Yes/No
   g. High blood pressure: Yes/No
   h. Any other heart problem that you've been told about: Yes/No

6. Have you ever had any of the following cardiovascular or heart symptoms?
   a. Frequent pain or tightness in your chest: Yes/No
   b. Pain or tightness in your chest during physical activity: Yes/No
   c. Pain or tightness in your chest that interferes with your job: Yes/No
   d. In the past two years, have you noticed your heart skipping or missing a beat: Yes/No
   e. Heartburn or indigestion that is not related to eating: Yes/No
   f. Any other symptoms that you think may be related to heart or circulation problems: Yes/No

7. Do you currently take medication for any of the following problems?
   a. Breathing or lung problems: Yes/No
   b. Heart trouble: Yes/No
   c. Blood pressure: Yes/No
   d. Seizures (fits): Yes/No

8. If you've used a respirator, have you ever had any of the following problems? (If you've never used a respirator, check the following space and go to question 9:)
   a. Eye irritation: Yes/No
   b. Skin allergies or rashes: Yes/No
   c. Anxiety: Yes/No
   d. General weakness or fatigue: Yes/No
   e. Any other problem that interferes with your use of a respirator: Yes/No

9. Would you like to talk to the health care professional who will review this questionnaire about your answers to this questionnaire: Yes/No

Questions 10 to 15 below must be answered by every employee who has been selected to use either a full-facepiece respirator or a self-contained breathing apparatus (SCBA). For employees who have been selected to use other types of respirators, answering these questions is voluntary.

10. Have you ever lost vision in either eye (temporarily or permanently): Yes/No
11. Do you currently have any of the following vision problems?
    a. Wear contact lenses: Yes/No
    b. Wear glasses: Yes/No
    c. Color blind: Yes/No
    d. Any other eye or vision problem: Yes/No
12. Have you ever had an injury to your ears, including a broken ear drum: Yes/No
13. Do you currently have any of the following hearing problems?
    a. Difficulty hearing: Yes/No
    b. Wear a hearing aid: Yes/No
    c. Any other hearing or ear problem: Yes/No
14. Have you ever had a back injury: Yes/No
15. Do you currently have any of the following musculoskeletal problems?
    a. Weakness in any of your arms, hands, legs, or feet: Yes/No
    b. Back pain: Yes/No
    c. Difficulty fully moving your arms and legs: Yes/No
    d. Pain or stiffness when you lean forward or backward at the waist: Yes/No
    e. Difficulty fully moving your head up or down: Yes/No
    f. Difficulty fully moving your head side to side: Yes/No
    g. Difficulty bending at your knees: Yes/No
    h. Difficulty squatting to the ground: Yes/No
    i. Climbing a flight of stairs or a ladder carrying more than 25 lbs: Yes/No
    j. Any other muscle or skeletal problem that interferes with using a respirator: Yes/No

Part B. Any of the following questions, and other questions not listed, may be added to the questionnaire at the discretion of the health care professional who will review the questionnaire.

1. In your present job, are you working at high altitudes (over 5,000 feet) or in a place that has lower than normal amounts of oxygen: Yes/No

   If "yes," do you have feelings of dizziness, shortness of breath, pounding in your chest, or other symptoms when you're working under these conditions: Yes/No

2. At work or at home, have you ever been exposed to hazardous solvents, hazardous airborne chemicals (e.g., gases, fumes, or dust), or have you come into skin contact with hazardous chemicals: Yes/No

   If "yes," name the chemicals if you know them:_____

   _____

   _____

3. Have you ever worked with any of the materials, or under any of the conditions, listed below:
    a. Asbestos: Yes/No
    b. Silica (e.g., in sandblasting): Yes/No
    c. Tungsten/cobalt (e.g., grinding or welding this material): Yes/No
    d. Beryllium: Yes/No
    e. Aluminum: Yes/No
    f. Coal (for example, mining): Yes/No
    g. Iron: Yes/No

h. Tin: Yes/No
i. Dusty environments: Yes/No
j. Any other hazardous exposures: Yes/No

If "yes," describe these exposures:_____

_____

_____

4. List any second jobs or side businesses you have:_____

_____

5. List your previous occupations:_____

_____

6. List your current and previous hobbies:_____

_____

7. Have you been in the military services? Yes/No

   If "yes," were you exposed to biological or chemical agents (either in training or combat): Yes/No

8. Have you ever worked on a HAZMAT team? Yes/No

9. Other than medications for breathing and lung problems, heart trouble, blood pressure, and seizures mentioned earlier in this questionnaire, are you taking any other medications for any reason (including over-the-counter medications): Yes/No

   If "yes," name the medications if you know them:_____

10. Will you be using any of the following items with your respirator(s)?
    a. HEPA Filters: Yes/No
    b. Canisters (for example, gas masks): Yes/No
    c. Cartridges: Yes/No

11. How often are you expected to use the respirator(s) (circle "yes" or "no" for all answers that apply to you)?
    a. Escape only (no rescue): Yes/No
    b. Emergency rescue only: Yes/No
    c. Less than 5 hours per week: Yes/No
    d. Less than 2 hours per day: Yes/No
    e. 2 to 4 hours per day: Yes/No
    f. Over 4 hours per day: Yes/No

12. During the period you are using the respirator(s), is your work effort:
    a. Light (less than 200 kcal per hour): Yes/No

       If "yes," how long does this period last during the average shift:_____hrs._____mins.

       Examples of a light work effort are ***sitting*** while writing, typing, drafting, or performing light assembly work; or ***standing*** while operating a drill press (1–3 lbs.) or controlling machines.
    b. Moderate (200 to 350 kcal per hour): Yes/No

       If "yes," how long does this period last during the average shift:_____hrs._____mins.

       Examples of moderate work effort are ***sitting*** while nailing or filing; ***driving*** a truck or bus in urban traffic; ***standing*** while drilling, nailing, performing assembly work, or transferring a moderate load (about 35 lbs.) at trunk level; ***walking*** on a level surface about 2 mph or down a 5-degree grade about 3 mph; or ***pushing*** a wheelbarrow with a heavy load (about 100 lbs.) on a level surface.
    c. Heavy (above 350 kcal per hour): Yes/No

       If "yes," how long does this period last during the average shift:_____hrs._____mins.

Examples of heavy work are ***lifting*** a heavy load (about 50 lbs.) from the floor to your waist or shoulder; working on a loading dock; ***shoveling; standing*** while bricklaying or chipping castings; ***walking*** up an 8-degree grade about 2 mph; climbing stairs with a heavy load (about 50 lbs.).

13. Will you be wearing protective clothing and/or equipment (other than the respirator) when you're using your respirator: Yes/No

    If "yes," describe this protective clothing and/or equipment:_____

    _____

14. Will you be working under hot conditions (temperature exceeding 77 deg. F): Yes/No
15. Will you be working under humid conditions: Yes/No
16. Describe the work you'll be doing while you're using your respirator(s):

    _____

    _____

17. Describe any special or hazardous conditions you might encounter when you're using your respirator(s) (for example, confined spaces, life-threatening gases):

    _____

    _____

18. Provide the following information, if you know it, for each toxic substance that you'll be exposed to when you're using your respirator(s):

    Name of the first toxic substance:_____

    Estimated maximum exposure level per shift:_____

    Duration of exposure per shift:_____

    Name of the second toxic substance:_____

    Estimated maximum exposure level per shift:_____

    Duration of exposure per shift:_____

    Name of the third toxic substance:_____

    Estimated maximum exposure level per shift:_____

    Duration of exposure per shift:_____

    The name of any other toxic substances that you'll be exposed to while using your respirator:

    _____

    _____

    _____

19. Describe any special responsibilities you'll have while using your respirator(s) that may affect the safety and well-being of others (for example, rescue, security):

    _____

    _____

Apéndice C: Cuestionario de Evaluación Médico obligado por la OSHA (La agencia de seguridad y salud ocupacional)

Parte 29 CFR 1910.134 Mandatorio para Protección del Sistema Respiratorio

Marque con un círculo para indicar sus respuestas a cada pregunta.

Para el empleado: Puede usted leer (circule uno): Sí o No

Su patrón debe dejarlo responder estas preguntas durante horas de trabajo o en un tiempo y lugar que sea conveniente para usted. Para mantener este cuestionario confidencial, su patrón o supervisor no debe ver o revisar sus respuestas. Su patrón debe informarle a quien dar o enviar este cuestionario para ser revisado por un profesional de sanidad con licencia autorizado por el estado.

Parte A. Sección 1. (Mandatorio): La siguiente información debe de ser proveida por cada empleado que ha sido seleccionado para usar cualquier tipo de respirador (escriba claro por favor).

1. Fecha :_____
2. Nombre:_____
3. Edad:_____
4. Su sexo (circule uno) Masculino o Femenino
5. Altura: _____pies _____pulgadas
6. Peso: _____libras
7. Su ocupación, título o tipo de trabajo: _____
8. Número de teléfono al donde pueda ser llamado por un profesional de sanidad con licencia que revisara este cuestionario (incluya el área): _____
9. Indique la hora más conveniente para llamarle a este mero:_____
10. ¿Le ha informado su patrón como comunicarse con el profesional de sanidad con licencia que va a revisar este cuestionario (circule una respuesta)? Sí o No
11. Anote el tipo de equipo protector respiratorio que va utilizar (puede anotar más de una categoría):
    a. _____ Respirador disponible de clase N, R, o P (por ejemplo: respirador de filtro mécánico, respirador sin cartucho)
    b. _____ Otros tipos (respirador con cartucho químico, máscara con cartucho químico, máscara con manguera con soplador (PAPR), máscara con manguera sin soplador (SAR), aparato respiratorio autónomos (SCBA)).
12. ¿Ha usado algún tipo de respirador? Sí o No

    Si ha usado equipo protector respiratorio, que tipo(s) ha utilizado:

    _____

    _____

Parte A. Sección 2. (Mandatorio): Preguntas del 1 al 9 deben ser contestadas por cada empleado que fue seleccionado a usar cualquier tipo de respirador. Marque con un círculo para indicar sus repuestas.

1. ¿Corrientemente fuma tabaco, o ha fumado tabaco durante el último mes? Sí o No
2. ¿Ha tenido algunas de las siguientes condiciones médicas?
    a. Convulsiones: Sí o No
    b. Diabetes (azúcar en la sangre): Sí o No
    c. Reacciones alérgicas que no lo deja respirar: Sí o No
    d. Claustrofobia (miedo de estar en espacios cerrados): Sí o No
    e. Dificultad oliendo excepto cuando ha cogido un resfriado: Sí o No

3 ¿Ha tenido algunas de los siguientes problemas pulmonares?
   a. Asbestosis: Sí o No
   b. Asma: Sí o No
   c. Bronquitis crónica: Sí o No
   d. Enfisema: Sí o No
   e. Pulmonía: Sí o No
   f. Tuberculosis: Sí o No
   g. Silicosis: Sí o No
   h. Neumotórax (pulmón colapsado): Sí o No
   i. Cáncer en los pulmones: Sí o No
   j. Costillas quebradas: Sí o No
   k. Injuria o cirugía en el pecho: Sí o No
   l. Algún otro problema de los pulmones que le ha dicho su médico: Sí o No

4. ¿Corrientemente tiene alguno de los siguientes síntomas o enfermedades en sus pulmones?
   a. Respiración dificultosa Sí o No
   b. Respiración dificultosa cuando camina rápido sobre terreno plano o subiendo una colina: Sí o No
   c. Respiración dificultosa cuando camina normalmente con otras personas sobre terreno plano: Sí o No
   d. Cuando camina normalmente en terreno plano se encuentra corto de resuello? Sí o No
   e. Respiración dificultosa cuando se está bañando o vistiendo: Sí o No
   f. Respiración dificultosa que lo impede trabajar: Sí o No
   g. Tos con flema: Sí o No
   h. Tos que lo despierta temprano en la mañana: Sí o No
   i. Tos que occurre cuando esta acostado: Sí o No
   j. Ha tosido sangre en el último mes: Sí o No
   k. Silbar o respirar con mucha dificultad: Sí o No
   l. Silbar que lo impede trabajar: Sí o No
   m. Dolor del pecho cuando respira profundamente: Sí o No
   n. Otros síntomas que crea usted estar relacionados a los pulmones: Sí o No

5. ¿Ha tenido algunos de los siguientes problemas con el corazón?
   a. Ataque cardiaco: Sí o No
   b Ataque cerebrovascular: Sí o No
   c. Dolor en el pecho: Sí o No
   d. Falla de corazón: Sí o No
   e. Hinchazón en las piernas o pies (que no sea por caminar): Sí o No
   f. Latidos irregulares del corazón: Sí o No
   g. Alta presión: Sí o No
   h. Algún otro problema cardio-vascular o cardiaco: Sí o No

6. ¿Ha tenido algunos de los siguientes síntomas causados por su corazón?
   a. Dolor de pecho frecuente o pecho apretado: Sí o No
   b. Dolor o pecho apretado durante actividad física: Sí o No
   c. Dolor o pecho apretado que no lo deja trabajar normalmente: Sí o No
   d. En los últimos dos años ha notado que su corazón late irregularmente: Sí o No
   e. Dolor en el pecho o indigestión que no es relacionado a la comida: Sí o No
   f. Algunos otros síntomas que usted piensa ser causado por problemas de su corazón o de su circulación. Sí o No

7. ¿Está tomando medicina por algunos de los siguientes problemas?
   a. Respiración dificultosa: Sí o No
   b. Problemas del corazón: Sí o No
   c. Alta presión: Sí o No
   d. Convulsiones: Sí o No

8. ¿Le ha causado alguno de los siguientes problemas usando el respirador? (si no ha usado un respirador, deje esta pregunta en blanco__ y continúe con pregunta 9).
   a. Irritación de los ojos: Sí o No

b. Alergias del cutis o sarpullido: Sí o No
c. Ansiedad que ocurre solamente cuando usa el respirado: Sí o No
d. Debilidad, falta de vigor o fatiga desacostumbrada: Sí o No
e. Algún otro problema que le impida utilizar su respirador: Sí o No

9. ¿Le gustaría hablar con el profesional de sanidad con licencia autorizado por el estado que revisara este cuestionario sobre sus respuestas? Sí o No

Las preguntas del 10 al 15 deben ser contestadas por los empleados seleccionados para usar una máscara con cartucho químico o aparato respiratorio autónomo (SCBA). Los empleados que usan otro tipo de respirador no tienen que contestar estas preguntas.

10 ¿Ha perdido la vista en cualquiera de sus ojos (temporalmente o permanente): Sí o No

11. ¿Corrientemente tiene algunos de los siguientes problemas con su vista?
    a. Usa lentes de contacto: Sí o No
    b. Usa lentes: Sí o No
    c. Daltoniano (dificultad distinguiendo colores): Sí o No
    d. Tiene algún problema con sus ojos o su vista: Sí o No

12. ¿Ha tenido daño en sus oídos incluyendo rotura del tímpano: Sí o No

13. ¿Corrientemente tiene uno de los siguientes problemas para oír?
    a. Dificultad oyendo: Sí o No
    b. Usa un aparato para oír: Sí o No
    c. Tiene algún otro problema con sus oídos o dificultad escuchando: Sí o No

14. ¿Se ha dañado o lastimado su espalda? Sí o No

15. ¿Tiene uno de los siguientes problemas de su aparato muscular o esqueleto?
    a. Debilidad en sus brazos, manos, piernas o pies: Sí o No
    b. Dolor de espalda: Sí o No
    c. Dificultad para mover sus brazos y piernas completamente: Sí o No
    d. Dolor o engarrotamiento cuando se inclina para adelante o para atrás: Sí o No
    e. Dificultad para mover su cabeza para arriba o para abajo completamente: Sí o No
    f. Dificultad para mover su cabeza de lado a lado: Sí o No
    g. Dificultad para agacharse doblando sus rodillas: Sí o No
    h. Dificultad para agacharse hasta tocar el piso: Sí o No
    i. Dificultad subiendo escaleras cargando más de 25 libras: Sí o No
    j. Alguno problema muscular o con sus huesos que le evite usar un respirador: Sí o No

Parte B—Las siguientes preguntas pueden ser agregadas al cuestionario a discreción del profesional de sanidad con licencia autorizado por el estado.

1. ¿Está trabajando en las alturas arriba de 5,000 pies o en sitios que tienen menos oxígeno de lo normal? Sí o No

   Si la respuesta es "Sí", se ha sentido mareado, o ha tenido dificultad respirando, palpitaciones, o cualquier otro síntoma que usted no tiene cuando no está trabajando bajo estas condiciones: Sí o No

2. ¿En el trabajo o en su casa, ha estado expuesto a solventes o contaminantes peligrosos en el aire (por ejemplo, humos, neblina o polvos) o ha tenido contacto del cutis con químicas peligrosas? Sí o No

   Escriba las químicas y productos con las que ha estado expuesto, si sabe cuales son:_____

   _____

3. ¿Ha trabajado con los siguientes materiales o las condiciones anotadas abajo?
    a. Asbestos: Sí o No
    b. Sílice (Limpiar mediante un chorro de arena): Sí o No
    c. Tungsteno/Cobalto (pulverizar o soldadura): Sí o No
    d. Berilio: Sí o No
    e. Aluminio: Sí o No

f. Carbón de piedra (minando): Sí o No
g. Hierro: Sí o No
h. Estaño: Sí o No
i. Ambiente polvoriento: Sí o No
j. Otra exposición peligrosa: Sí o No

Describa las exposiciones peligrosas:

_____

_____

4. ¿Tiene usted otro trabajo o un negocio aparte de este?_____

_____

_____

5. Apunte sus previos trabajos:_____

_____

_____

6. Apunte sus pasatiempos:_____

_____

_____

7. ¿Tiene servicio militar? Sí o No

   Si la respuesta es "Sí", ha estado expuesto a agentes químicos o biológicos durante entrenamiento o combate: Sí o No

8. ¿Alguna vez ha trabajado en un equipo de HAZMAT (equipo respondedor a incidentes de materiales peligrosos con emergencia)? Sí o No

9. ¿Está tomando alguna medicina que no haya mencionado en este cuestionario (incluyendo remedios caseros o medicinas que compra sin receta)? Sí o No

   Si la respuesta es "Sí", cuales son _____

10. ¿Va a usar algunas de las siguientes partes con su respirador?
    a. filtros HEPA (filtro de alta eficiencia que remueve partículas tóxicas en la atmósfera): Sí o No
    b. Canastillo (por ejemplo, máscara para gas): Sí o No
    c. Cartuchos: Sí o No

11. ¿Cuántas veces espera usar un respirador?
    a. Para salir de peligro solamente (no rescates): Sí o No
    b. Recates de emergencia solamente: Sí o No
    c. Menos de 5 horas por semana: Sí o No
    d. Menos de 2 horas por día: Sí o No
    e. 2 a 4 horas por día: Sí o No
    f. Más de 4 horas por día: Sí o No

12. ¿Durante el tiempo de usar el respirador, su trabajo es?
    a. Ligero (menos de 200 kcal por hora): Sí o No

    Si la respuesta es "sí", cuanto tiempo dura la obra _____horas _____minutos

    Ejemplos de trabajos ligeros: estar sentado escribiendo, escribiendo a máquina, diseñando, trabajando la línea de montaje, o estar parado gobernando un taladro o máquinas:
    b. Moderado (200-350 kcal por hora): Sí o No

    Si la respuesta es "sí" cuanto tiempo dura en promedio por jornada _____horas_____minutos

Ejemplos de trabajos moderados: sentado clavando o archivando; manejando un camión o autobús en tráfico pesado; estar de pie taladrando, clavando, trabajando la línea de montaje, o transfiriendo una carga (de 35 libras) a la altura de la cintura; caminando sobre tierra plana a 2 millas por hora o bajando a 3 millas por hora; empujando una carretilla con una carga pesada (de 100 libras) sobre terreno plano.

c. Pesado (más de 350 kcal por hora): Sí o No

Si la respuesta es "sí"cuanto tiempo dura en promedio por jornada _____horas_____minutos

Ejemplos de trabajos pesados: levantando cargas pesadas (más de 50 libras) desde el piso hasta la altura de la cintura o los hombros; trabajando cargando o descargando; transpalear; estar de pie trabajando de albañil o desmenuzando moldes; subiendo a 2 millas por hora; subiendo la escalera con una carga pesada (más de 50 libras).

13. ¿Va a estar usando ropa o equipo de proteción cuando use el respirador? Sí o No

    Si la respuesta es "sí" describa que va a estar usando_____

    _____

14. ¿Va a estar trabajando en condiciones calurosas (temperatura más de 77 grados F)? Sí o No
15. ¿Va a estar trabajando en condiciones húmedas? Sí o No
16. Describa el tipo de trabajo que va a estar usted haciendo cuando use el respirador.

    _____

    _____

17. Describa cualquier situación especial o peligrosa que pueda encontrar cuando este usando el respirador (por ejemplo, espacios encerrados, gases que lo puedan matar, etc.)

    _____

18. Provea la siguiente información si la sabe, por cada sustancia tóxica que usted va a estar expuesto cuando este usando el respirador(s):

    Nombre de la primera sustancia tóxica _____

    Máximo nivel de exposición por jornada de trabajo_____

    Tiempo de exposición por jornada_____

    Nombre de la segunda sustancia tóxica_____

    Máximo nivel de exposición por jornada de trabajo_____

    Tiempo de exposición por jornada_____

    Nombre de la tercera sustancia tóxica _____

    Máximo nivel de exposición por jornada de trabajo _____

    Tiempo de exposición por jornada _____

    El nombre de cualquier sustancia tóxica que usted va a estar expuesto cuando este usted usando el Respirador

    _____

    _____

    _____

19. Describa alguna responsabilidad especial que usted va a tener cuando usted este usado el respirador(s) que pueda afectar la seguridad o la vida de otros (por ejemplo, rescate, seguridad).

    _____

    _____

Appendix III

Required Information for Voluntary Use (English & Spanish)

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:

1. Read and heed all instructions provided by the manufacturer on use, maintenance, cleaning and care, and warnings regarding the respirators limitations.
2. Choose respirators certified for use to protect against the contaminant of concern. NIOSH, the National Institute for Occupational Safety and Health of the U.S. Department of Health and Human Services, 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.
3. 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.
4. Keep track of your respirator so that you do not mistakenly use someone else’s respirator.

Apéndice D—Información para Trabajadores que Usan Respiradores Voluntariamente (Obligatorio)

Los respiradores que son seleccionados y usados correctamente son un método de protección efectivo contra peligros designados. OSHA promueve el uso de respiradores, aunque la exposición sea menor al límite permitido de exposición, para proveer un mejor nivel de comodidad y protección a los trabajadores. Sin embargo, si usted usa su respirador de manera incorrecta o si la limpieza adecuada no es mantenida, el respirador mismo podría convertirse en un peligro. Los trabajadores pueden usar los respiradores para evitar la exposición a peligros aunque la cantidad de substancias peligrosas no exceda los límites establecidos bajo las reglas de OSHA. Si su empleador provee respiradores para uso voluntario, o si usted provee su propio respirador, necesita tomar ciertas precauciones para asegurarse de que el respirador no presenta ningún peligro.

Usted debería hacer lo siguiente:

1. Lea y siga todas las instrucciones del fabricante acerca del uso, mantenimiento, limpieza y cuidado. También siga las instrucciones acerca de las advertencias en cuanto a las limitaciones del respirador.
2. Elija respiradores que sean certificados para ser usados en la clase de atmósfera contaminada, específica a su situación El Instituto Nacional para Salud y Seguridad Ocupacional del Departamento de Salud y Servicios Humanos (NIOSH por sus siglas en inglés) certifica respiradores. Una certificación o declaración que debe aparecer en el respirador o paquete del respirador le dirá para qué clase de uso el respirador está diseñado y la capacidad de protección que éste ofrece.
3. No use su respirador en atmósferas que contengan contaminantes si éste no está diseñado para protegerlo en esos ambientes. Por ejemplo, un respirador que está diseñado para filtrar partículas de polvo, no lo protegerá contra gases, vapores o partículas sólidas muy pequeñas de humo.
4. Marque su respirador claramente para que por error usted no use el respirador de otra persona.

Appendix IV

Sample Respiratory Protection Programs and Other Information

Sample Programs

Sample Respiratory Protection programs (required use and voluntary use)
http://www.nclabor.com/osha/consult/sample_programs.htm

Standards

Respiratory Protection Standard, 29 CFR 1910.134
http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=12716)

Respiratory Protection Standard—Appendix A (Fit Test Procedures)
http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9780)

Operating Documents

Respiratory Protection Compliance Directive—CPL 02-00-120
http://www.osha.gov/OshDoc/Directive_pdf/CPL_2-0_120.pdf

Respiratory Protection Interpretations (Federal OSHA)
http://www.osha.gov/pls/oshaweb/owasrch.search_form?p_doc_type=INTERPRETATIONS&p_toc_level=3&p_keyvalue=1910.134&p_status=CURRENT

Publications

Respiratory Protection Quick Card
http://www.nclabor.com/osha/Quick%20Card%20PDFs/Respirators%20Card.pdf

Training Resources

Respiratory Protection videos
http://www.nclabor.com/lib/avlist.htm#RESPIRATORY%20PROTECTION

Other Agency Information

NIOSH Respiratory Protection Subject Index Page
http://www.cdc.gov/niosh/npptl/topics/respirators/

The following industry guides are available from the N.C. Department of Labor's Occupational Safety and Health Division:

#1. *A Guide to Safety in Confined Spaces*
#2. *A Guide to Procedures of the N.C. Occupational Safety and Health Review Commission* (downloadable PDF **ONLY**)
#3. *A Guide to Machine Safeguarding*
#4. *A Guide to Occupational Safety and Health in North Carolina*
#5. *A Guide for Persons Employed in Cotton Dust Environments* (downloadable PDF **ONLY**)
#6. *A Guide to Lead Exposure in the Construction Industry* (downloadable PDF **ONLY**)
#7. *A Guide to Bloodborne Pathogens in the Workplace*
#8. *A Guide to Voluntary Training and Training Requirements in OSHA Standards*
#9. *A Guide to Ergonomics*
#10. *A Guide to Farm Safety and Health* (downloadable PDF **ONLY**)
#11. *A Guide to Radio Frequency Hazards With Electric Detonators* (downloadable PDF **ONLY**)
#12. *A Guide to Forklift Operator Training*
#13. *A Guide to the Safe Storage of Explosive Materials* (downloadable PDF **ONLY**)
#14. *A Guide to the OSHA Excavations Standard*
#15. *A Guide to Developing and Maintaining an Effective Hearing Conservation Program*
#16. *A Guide to Construction Jobsite Safety and Health/Guía de Seguridad y Salud para el Trabajo de Construcción*
#17. *A Guide to Asbestos for Industry*
#18. *A Guide to Electrical Safety*
#19. *A Guide to Occupational Exposure to Wood, Wood Dust and Combustible Dust Hazards* (downloadable PDF **ONLY**)
#20. *A Guide to Cranes and Derricks*
#23. *A Guide to Working With Electricity*
#25. *A Guide to Personal Protective Equipment*
#26. *A Guide to Manual Materials Handling and Back Safety*
#27. *A Guide to the Control of Hazardous Energy (Lockout/Tagout)*
#28. *A Guide to Eye Wash and Safety Shower Facilities*
#29. *A Guide to Safety and Health in Feed and Grain Mills* (downloadable PDF **ONLY**)
#30. *A Guide to Working With Corrosive Substances*
#31. *A Guide to Formaldehyde* (downloadable PDF **ONLY**)
#32. *A Guide to Fall Prevention in Industry*
#32s. *Guía de Prevención de las Caídas en la Industria (Spanish version of #32)*
#33. *A Guide to Office Safety and Health* (downloadable PDF **ONLY**)
#34. *A Guide to Safety and Health in the Poultry Industry* (downloadable PDF **ONLY**)
#35. *A Guide to Preventing Heat Stress and Cold Stress*
#38. *A Guide to Safe Scaffolding*
#40. *A Guide to Emergency Action Planning*
#41. *A Guide to OSHA for Small Businesses in North Carolina*
#41s. *Guía OSHA para Pequeños Negocios en Carolina del Norte (Spanish version of #41)*
#42. *A Guide to Transportation Safety*
#43. *A Guide to Combustible Dusts*
#44. *A Guide to Respiratory Protection*
#45. *A Guide to Hexavalent Chromium Cr(VI) for Industry*
#46. *A Guide to Occupational Exposure to Isocyanates*

Occupational Safety and Health (OSH)
Sources of Information

You may call 1-800-NC-LABOR (1-800-625-2267) to reach any division of the N.C. Department of Labor; or visit the NCDOL home page on the World Wide Web: http://www.nclabor.com.

N.C. Occupational Safety and Health Division

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Local Telephone: 919-807-2900 Fax: 919-807-2856

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 3rd Floor)

For information concerning education, training, interpretations of occupational safety and health standards, and OSH recognition programs contact:

Education, Training and Technical Assistance Bureau

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: 919-807-2875 Fax: 919-807-2876

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 4th Floor)

For information concerning occupational safety and health consultative services contact:

Consultative Services Bureau

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: 919-807-2899 Fax: 919-807-2902

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 3rd Floor)

For information concerning migrant housing inspections and other related activities contact:

Agricultural Safety and Health Bureau

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: 919-807-2923 Fax: 919-807-2924

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 2nd Floor)

For information concerning occupational safety and health compliance contact:

Safety and Health Compliance District Offices

Raleigh District Office (3801 Lake Boone Trail, Suite 300, Raleigh, NC 27607)
Telephone: 919-779-8570 Fax: 919-420-7966

Asheville District Office (204 Charlotte Highway, Suite B, Asheville, NC 28803-8681)
Telephone: 828-299-8232 Fax: 828-299-8266

Charlotte District Office (901 Blairhill Road, Suite 200, Charlotte, NC 28217-1578)
Telephone: 704-665-4341 Fax: 704-665-4342

Winston-Salem District Office (4964 University Parkway, Suite 202, Winston-Salem, NC 27106-2800)
Telephone: 336-776-4420 Fax: 336-776-4422

Wilmington District Office (1200 N. 23rd St., Suite 205, Wilmington, NC 28405-1824)
Telephone: 910-251-2678 Fax: 910-251-2654

*****To make an OSH Complaint,* OSH Complaint Desk:** 919-807-2796***

For statistical information concerning program activities contact:

Planning, Statistics and Information Management Bureau

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: 919-807-2950 Fax: 919-807-2951

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 2nd Floor)

For information about books, periodicals, vertical files, videos, films, audio/slide sets and computer databases contact:

N.C. Department of Labor Library

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: 919-807-2848 Fax: 919-807-2849

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 5th Floor)

N.C. Department of Labor (Other than OSH)

1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: 919-733-7166 Fax: 919-733-6197