

RESPIRATORY PROTECTION PROGRAM:

Requirements for Air-Purifying Respirators

Northwestern University ❖ Vice President for Research ❖ Chemical and Biological Safety Committee ❖ Office of Research Safety

I. OVERVIEW

A. Introduction. “I think we need respirators in our workplace; what do we do?”

First, we must establish whether you really need a respirator or whether the inhalation hazard can be controlled in another way. Respirators are considered a “last resort” protection against inhalation hazards. The Occupational Safety and Health Administration (OSHA) states: *“In the control of those occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective shall be to prevent atmospheric contamination. This shall be accomplished as far as feasible by accepted engineering control measures (for example, enclosure or confinement of the operation, general or local ventilation, and substitution of less toxic materials).”*

All feasible and accepted engineering control measures for preventing atmospheric contamination shall have been exhausted before turning to respirators for worker protection. If you have made that effort but suspect that atmospheric contamination is still a problem, call the Office of Research Safety (ORS). ORS will perform a hazard evaluation and advise you whether respirators or other engineering controls are needed.

Even when evaluation reveals that respirators are not required, some workers may want to wear them voluntarily if the principal investigator/supervisor agrees to this. In that case, depending on the type of respirator chosen, many of the regulatory requirements are the same as if respirators were required.

Section II guides you step-by-step through the process of evaluating the hazard, obtaining medical evaluation, selecting and fit testing respirators, and training wearers.

B. Responsibilities. Principal investigators and supervisors, respirator wearers, and administrative units have well-defined responsibilities under this program. The principal investigator (PI) or supervisor controls the conditions of the workplace. PIs or supervisors are responsible for initiating the respiratory protection process, overseeing proper use and maintenance of respirators and other equipment, initiating action when conditions change, following established schedules, and providing (paying for) respirators and associated supplies. Respirator wearers are responsible for adhering to procedures and following schedules, bringing changing conditions to the attention of the PI/supervisor, and caring for their equipment. ORS services include providing the general written respirator program (this document) and assisting with hazard evaluation, respirator selection, fit testing, training of respirator users, identifying medical evaluation providers and maintenance activities. Both PIs/supervisors and ORS must maintain some records.

C. Regulatory Background and University Policy. The respiratory protection program is required by the OSHA Standard for Respiratory Protection, 29 CFR 1910.134, which went into effect on April 8, 1998. University policy designates the PI/supervisor as the employer responsible for ensuring adherence to safety regulations and procedures. University policy is recommended by the Chemical and Biological Safety Committee and approved by the vice president for research.

D. Necessity for Respirators. Respirators are required if engineering controls are insufficient and the worker’s exposure is expected to be above the permissible exposure limit (PEL¹) established by OSHA for the contaminant of concern. For compounds with no set PEL, professional judgment and scientific data steer the decision concerning the use of respirators. When a respirator is warranted, the PI/supervisor must select a respirator that will reduce the worker’s exposure to a level below the concentration considered hazardous by the scientific literature.

¹ A PEL is the time-weighted average concentration for a conventional 8-hour workday and a 40-hour workweek, to which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse effect.

E. Required Versus Voluntary Use. The hazard evaluation will determine whether workers are required to wear respirators or whether engineering controls can eliminate the hazard. Even when it can be demonstrated that exposures are under the standard hazard limit (e.g., the PEL), some workers may choose to voluntarily wear a respirator. See section VI for further clarification of required and voluntary use. It is important to understand that many of the same requirements apply to voluntary wearers. These requirements are noted throughout this document. Appendix A provides additional information that should be given to voluntary wearers. The PI/supervisor will determine if voluntary use is acceptable or whether to make respirator use mandatory.

F. What PIs/Supervisors Need to do on a Continuing Basis.

- Be aware of changing circumstances in the workplace that may affect the need for respirators, such as introduction of new processes or chemicals, increased use of given chemical volume, or alterations in the ventilation system. Call ORS for advice when you become aware of such changes.
- Be aware of changes in working conditions that may effect the ability of wearers to use respirators effectively, such as conditions of heat and humidity, significant change in the work effort, new protective clothing or equipment, or other environmental factors.
- Be aware of changes in wearers' physical ability to wear a respirator, such as growth of facial hair, dental work, new eyeglasses, changes in body weight, and so forth. If a worker reports medical signs and symptoms related to respirator use you must bring them to the attention of the health care professional for evaluation.
- Maintain surveillance of the work area and instruct respirator wearers to leave the work area a) to wash their skin and respirator as necessary to prevent irritation, b) if they detect breakthrough, changes in resistance or leakage, or c) to replace the respirator, filter, cartridge, or canister elements.
- Establish an inspection schedule to ensure that respirators are maintained in a clean and operable condition.
- Maintain a supply of appropriate cleaning and disinfecting supplies and establish a cleaning and disinfecting protocol.
- Ensure that respirator wearers perform a facepiece seal check each time they don the respirator.
- Adhere to the schedule for annual fit testing.
- Ensure respirators are properly stored between uses.

G. Cost. The PI/supervisor shall provide respirators, medical evaluations, fit testing, training, and all services and equipment associated with both voluntary and mandatory respirator use (e.g., replacement of defective parts, disinfecting solutions, storage bags, etc.) at no cost to the workers. As OSHA states, the obligation of the employer to pay the costs of the respiratory protection program should be "crystal clear."

H. Cleaning, Disinfecting, Maintenance and Repair. Routine cleaning, disinfecting, and maintaining respirators are the responsibility of the wearer under supervision of the PI/supervisor. See sections VIII and IX for more information on cleaning and disinfecting and a checklist for routine maintenance.

II. PROCEDURES FOR ACQUIRING A RESPIRATOR

Step 1: Hazard Evaluation. The first step is to perform, or have performed, a hazard evaluation to determine whether atmospheric contamination exceeds or is likely to exceed the hazard limit. ORS will perform the evaluation on request. ORS will work with you to find methods to reduce levels of atmospheric contamination. If such methods are not sufficient and respirators are required, proceed to the next step, medical evaluation of respirator wearers.

Step 2: Medical Evaluation. A physician or other licensed health care professional (PLHCP²) is required to determine whether or not a potential respirator wearer is physically able to wear a respirator without adverse health effects. Every worker must be medically evaluated prior to fit testing and before wearing a respirator.

Using a respirator may place a physiological burden on a worker that varies with the type of respirator worn, the job and workplace conditions in which the respirator is used, and the medical status of the individual. Respirator wearers may suffer from medical conditions (e.g., asthma, emphysema, heart disease, claustrophobia, and medications) that preclude safe use of a respirator.

² PLHCP includes nurse practitioners, physician assistants, and occupational health nurses, provided that their licenses permit them to perform respirator medical evaluations.

Prior to the medical evaluation the PI/supervisor is responsible for completing Appendix B and providing it to the PLHCP. Appendix B provides the following information to the PLHCP:

- the type and weight of the respirator to be used by the worker
- the duration and frequency of respirator use
- the expected physical work effort
- additional protective clothing and equipment to be worn
- temperature and humidity extremes that may be encountered.

At the time of the medical evaluation the worker needs to complete the mandatory *OSHA Respirator Medical Evaluation Questionnaire* (Appendix C) and provide it to the PLHCP. The questionnaire is available from the Office of Research Safety. Follow-up medical evaluations may be required annually.

Make an appointment with a PLHCP. The following organizations or persons can provide medical evaluations:

Chicago Campus

- Northwestern Memorial Hospital Corporate Health, Galter Pavilion, 201 East Huron Street, 9th floor – Suite 240, Chicago, IL, phone (312) 926-8282. This is the University's designated health care provider for occupational illnesses and injuries. Be prepared to provide a CUFS number.

Evanston Campus

- University Health Service, Dr. Mark Gardner, phone (847) 491-8100. Employees are advised to make appointments well in advance if using this facility. Students can be evaluated on a shorter schedule. Be prepared to provide a CUFS number.
- OMEGA (Occupational Medicine-Evanston/Glenbrook Associates), 1000 Central Street, Suite 840, Evanston, IL, phone (847) 570-2620. OMEGA is the University's designated health care provider for occupational illnesses and injuries.

Contact ORS for more information about any of these options. The regulation requires that each PLHCP have a copy of the University's program and the OSHA regulation. ORS has already given them to the listed providers. If another provider is used, make they have the required documents. They may be obtained from ORS.

The PI/supervisor is required to ensure that both the questionnaire and the medical evaluation are to be administered confidentially during the worker's normal working hours or at a time and place convenient to the worker. The PI/supervisor shall also ensure that the worker has an opportunity to discuss the questionnaire and/or medical evaluation results with the PLHCP.

Following the review of the questionnaire and/or examination of the worker, the PLHCP must submit a written recommendation regarding the worker's ability to use the respirator to the PI/supervisor. The recommendation may contain only the following information:

- any limitations on respirator use related to the medical condition of the worker, or relating to the workplace conditions in which the respirator will be used, including whether or not the worker is medically able to use the respirator
- the need, if any, for any follow-up medical evaluations
- a statement that the PLHCP has given the worker a copy of the written recommendation concerning the evaluation.

Step 3: Respirator Selection. After receiving medical clearance for respirator use, make an appointment with ORS.

At this meeting ORS will advise you on the types of respirators to purchase. It is the PI/supervisor's responsibility to provide, and pay for, all personal protective clothing and equipment, including respirators.

Step 4: Fit Testing. Fit testing is required before the worker first wears the respirator and annually thereafter. Call ORS to make an appointment for fit testing. Repeat fit testing may be required if the respirator wearer or PI/supervisor notices changes in the wearers' physical condition that could affect fit, and if a different facepiece is used. There is no charge for fit testing by ORS. While not required for voluntary wearers, fit testing is recommended.

Step 5: Training. Following fit testing, each wearer must receive basic respirator training from ORS. Training is offered at the time of fit testing or on a scheduled basis. Voluntary wearers are not required to be trained except for the information in Appendix A, however ORS recommends they receive the standard training.

III. TYPES OF RESPIRATORS

A. Air-Purifying Respirators. Ambient air is passed through an air-purifying element (filter, cartridge, canister) that removes the specific contaminants (particulates, vapors, and gases). There are two subdivisions of this category.

1. Negative-pressure air-purifying respirator: Air is passed through the air-purifying element by means of the breathing action of the wearer. Air pressure inside the respiratory inlet covering is negative during inhalation with respect to the ambient air pressure.
2. Powered air-purifying respirator (PAPR): Air is passed through the air-purifying element by means of a battery-powered blower.

Within the category of negative-pressure air-purifying respirator, there is a further subdivision. Such a respirator may be a filtering facepiece (traditionally known as a dust or dust-, mist-, fume mask) or a facepiece equipped with replaceable filters, cartridges, or canisters. The filtering facepiece is 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.

A facepiece with separate, replaceable filtering elements is a tight-fitting respirator that forms a complete seal with the face. For the purposes of this document, filtering facepieces are not considered to be tight-fitting respirators.

The PI or supervisor shall provide a National Institute for Occupational Safety and Health (NIOSH) certified air-purifying respirator. This means that the respirator meets the stringent testing conventions of NIOSH 42 CFR Part 84, the final rule for *Respiratory Protective Devices*. See section V for an explanation of the certification elements.

The respirator must be used in compliance with the conditions of its certification.

- Failure to use and maintain the respirator properly could result in injury.
- Do not exceed the maximum use concentrations established by regulatory standards.
- Never substitute, modify, add, or omit parts. Use only exact replacement parts in the configuration specified by the manufacturer.

B. Atmosphere-Supplying Respirators. Atmosphere-supplying respirators supply a respirable atmosphere independent of the workplace atmosphere. These units provide protection against toxic and oxygen-deficient atmospheres. The different types within this category are classified according to the method by which the breathing gas is supplied and the method applied to regulate the gas supply. A self-contained breathing apparatus (SCBA) is one example in this category. With SCBA units, the respirable gas source is carried by the wearer.

Atmosphere-supplying respirators are required in environments that are immediately dangerous to life or health (IDLH). IDLH refers to 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. This includes situations such as these:

- A short, one-time exposure (i.e., acute exposure) to a given compound above its IDLH value may cause death or irreversible adverse health effects immediately, within a few hours or a few weeks. For example, a single exposure to life-threatening or health-impairing concentrations of fluorides or cadmium fumes would be termed IDLH even though death or impairment might not occur until days or weeks after the exposure. It is not the length of the latency period that defines a concentration as IDLH; rather, it is the potential to cause that effect after only one exposure.
- Atmospheres that can effectively incapacitate an individual in the short-term are IDLH. For example, an atmosphere contaminated with a severe eye irritant may prevent an employee from escaping the space in time to avoid more serious health consequences.
- OSHA offers no differentiation between "potential" IDLH atmospheres and actual ones. If there is a possibility that the concentration of the dangerous substance cannot be controlled below life-threatening or health-impairing levels, it is deemed IDLH regardless of whether an inadvertent hazardous spill or release occurs.

Workers should have the training and capability to evacuate a workplace before exposure concentrations reach IDLH levels. The same is true for materials that displace oxygen. If normal workplace ventilation is maintained during an unplanned release of nitrogen or helium, workers should be trained to recognize the hazard and have sufficient time to exit the workplace before an oxygen-deficient (less than 19.5% by volume) atmosphere can result.

For those who work with highly toxic gases³ (such as arsine and phosphine, for example), training in evaluating the hazard is not sufficient. The IDLH limits for these materials are extremely low. Any unplanned release will likely exceed IDLH concentrations. Thus, in addition to worker training, toxic gas alarm systems should be available and operating properly to ensure early notification of lab occupants. They must have the opportunity to escape the environment promptly.

If you determine that atmosphere-supplying respirators will be necessary in your workplace (e.g., for emergencies or potential escape from toxic conditions), consult ORS. ORS is available on a 24-hour basis, every day for emergency response. If you anticipate emergencies of such a nature as to require air-supplying units, we encourage you to rely on our fully-equipped team instead of acquiring this specialized equipment yourself. These types of specialized units involve intense maintenance and training.

C. Additional Resources for Understanding Respirator Design and Function. More information about respirator types is available in the NIOSH Guide to Industrial Respiratory Protection, 1987, or the American National Standards Institute (ANSI) "Standard for Respiratory Protection," ANSI Z88.2-1992. Copies of these references are available for viewing in ORS.

IV. SELECTION OF THE PROPER RESPIRATOR

A. Guidelines for Selection. In general, selection of the proper respirator shall be based on:

1. the nature of the hazardous operation
2. the character of the respiratory hazard
 - physical properties of expected contaminants
 - oxygen deficiency
 - adverse effects of expected contaminants on the body
 - concentration of the contaminant (determined through informed professional judgment or exposure monitoring)
 - magnitude of the hazard under normal conditions of use and in reasonably foreseeable emergency conditions
 - established exposure limits set by OSHA, American Conference of Governmental Industrial Hygienists (ACGIH), and NIOSH
3. the location of the hazardous area in relation to the nearest area having safe, respirable air of acceptable quality
4. the period of time during which respiratory protection must be worn
5. the activities of the wearer
6. the physical characteristics, functional capabilities, and limitations of the various respirators under consideration
7. the assigned protection factor (APF) for the given type of respirator to be worn. An APF is the expected level of respiratory protection that would be provided by a properly functioning respirator when worn by a properly fitted and trained user. Depending on the respirator, the APF is a magnitude of protection (10x, 100x, etc.) over the OSHA PEL (or other applicable concentration limit when there is no PEL) afforded by the protecting device.

Should you find that you cannot identify or reasonably estimate the worker exposure, the atmosphere will be classified as IDLH by default, and entry would require the use of atmosphere-supplying respirators.

B. Limitations of Air-Purifying Respirators That May Disqualify Them From Use.

1. General Limitations
 - No protection is provided against absorption of chemicals through the skin, nor against skin irritation.
 - These respirators do not protect against oxygen-deficient atmospheres. They are designed only to neutralize or remove contaminants from the air.
 - The maximum contaminant concentration for which protection is offered is limited by the design efficiency and capacity of the air-purifying element (filter, cartridge, and canister).
 - The time period over which protection is offered is dependent on the type of air-purifying element, the concentration of the contaminant, humidity levels in the ambient air, and the wearer's respiratory rate.
 - The facepiece must be fitted carefully to the wearer's face to prevent inward leaks.
2. Specific Limitations
 - Quarter- and half-face respirators offer no protection against eye irritation.

³ Highly toxic gases are defined as those that demonstrate a median lethal concentration (LC₅₀) of 200 ppm or less when administered by inhalation for an hour (or less if death occurs within one hour) to albino rats weighing between 200 and 300 grams each.

- Full-face respirators cannot be worn with eyeglasses since the frame stems interfere with the facepiece seal. Prescription spectacle kits must be available to those wearers who require vision correction. In the absence of individual workplace policy to the contrary, contact lenses are permitted to be worn with the full-face respirator. The respirator should not be worn unless vision is adequate for personal safety.
- Negative-pressure respirators may cause discomfort due to a noticeable resistance to inhalation.

C. Resources that Aid in Selection. ORS can provide listings of OSHA PELs, ACGIH threshold limit values (TLVs), NIOSH-recommended exposure limits (RELs), NIOSH-published IDLH values, and literature regarding specific respirator capabilities and APFs. Logical decision trees which aid in choosing the correct respirator have been prepared by both NIOSH and ANSI. Please consult ORS before purchasing respirators to make use of these valuable resources.

V. AIR-PURIFYING ELEMENTS

A. General Warning. If the wearer is uncertain that the respiratory protection chosen for a particular inhalation hazard is satisfactory, the appropriateness of that protection should be verified by the PI/supervisor, ORS, and/or the manufacturer of the respirator. Use of an incorrect air-purifying element or respirator (i.e., air-purifying versus supplied air) will negate the expected protection against potential health hazards!

B. Particulate-Filter Units. The NIOSH 42 CFR Part 84 regulation provides for nine classes of particulate filters: three levels of filter efficiency, each with three categories of resistance to filter efficiency degradation. The three levels of filter efficiency are 95%, 99%, and 99.97%. The three categories of resistance to filter efficiency degradation are labeled N, R, and P.

NOTE: These nine categories apply only to negative-pressure air-purifying, particulate-filter respirators. PAPRs for particulates are approved only with highest-efficiency filters (N100, R100, P100).

1. **Filter Efficiency.** Filter efficiency is the stated percentage of particles removed from the air. Selection of filter efficiency (i.e., 95%, 99%, or 99.97%) depends on how much filter leakage can be accepted. Higher filter efficiency means lower filter leakage.

NIOSH states that filters certified under 42 CFR Part 84 can be selected without regard to particle size. All filters tested under the approved procedures will be effective against any size aerosol.

2. **Filter Efficiency Degradation.** Filter efficiency degradation is defined as a lowering of filter efficiency or a reduction in the ability of the filter to remove particles as a result of workplace exposure.

The selection of N-, R-, and P-series filters depends on the presence or absence of oil particles, as follows:

- if no oil particles are present in the work environment, use a filter of any series (i.e., N-, R, or P-series)
 - if oil particles (e.g., lubricants, cutting fluids, glycerine, etc.) are present, use an R- or P-series filter
- NOTE: N-series filters cannot be used if oil particles are present.
- if oil particles are present and the filter is to be used for more than one work shift, use only a P-series filter

To help remember the filter series, this simple guide is useful.

- N is for Not resistant to oil
- R is for Resistant to oil
- P is for oil-Proof

3. **Selection Guide for Particulate Filters.**
 - Identify the aerosol contaminants and form (oil or nonoil)
 - Determine the expected concentration of air contaminants. Do not use these guidelines if the following situations exist.
 - a) unknown contaminant concentration
 - b) contaminant concentration is at or above the IDLH value for that contaminant
 - c) oxygen concentrations are below or may fall below 19.5%
 - Determine the hazard ratio (HR) for all substances. The HR is the ratio of the air concentration of the hazardous contaminant(s) divided by the occupational exposure limit.
 - a) If the highest HR is less than or equal to 10, use either a half- or full-face respirator.

- b) If the highest HR is between 10 and 50, use a full-face respirator.
- c) If the highest HR is greater than 50, another type of respirator must be selected.
- Determine the filter efficiency required.
 - a) Use a class 100 (99.97% efficiency) filter if required by a specific regulation or regulatory policy.
 - b) If no such regulation or policy exists, use a class 95 (95% efficiency) filter.
- Determine the filter series needed.
 - a) If no oil is present, use a N-, R-, or P-series filter.
 - b) If oil is present, use a R- or P-series filter.
 - c) R-series filters must be changed after 8 hours of use or after the respirator is loaded with (exposed to) 200 mg of aerosol.
 - d) Where oil is suspected but air samples have not been collected to determine its presence, use a R- or P-series filter.
- Identify workplace and respirator characteristics to choose the most appropriate respirator within the specific filter class you have selected. Consider:
 - a) maintenance capabilities
 - b) fit
 - c) compatibility with other PPE
 - d) durability
 - e) breathing resistance/wearer acceptance

C. Chemical Cartridges: Gas and Vapor Contaminants.

1. **Acidic** (acid gases). Substances that are acids or that react with water to produce an acid. In water, they produce positively charged hydrogen ions (H⁺) and a pH of less than 7. They taste sour and many are corrosive to tissues (e.g., hydrogen chloride, sulfur dioxide; hydrogen sulfide – escape only).

NOTE: Air-purifying respirators are not appropriate for all acid gases. For example, fluorine is classified as being acidic; however, due to its poor warning properties, supplied air is the warranted protection. Hydrogen cyanide is characterized by a very low IDLH and thus requires supplied air. Air-purifying respirators with custom filters are rated as adequate protection for chlorine dioxide but the full-face respirator is recommended. Air-purifying respirators with filters for protection from hydrogen sulfide are only good for short duration exposures and should not be used as PPE for worker protection.

2. **Alkaline**. Substances that are bases or that react with water to produce a base. In water, they result in the production of negatively charged hydroxyl ions (OH⁻) and a pH greater than 7. They taste bitter and many are corrosive to tissues (e.g., ammonia, methylamine, butylamine, ethylamine).

NOTE: Within the category of alkaline substances, air-purifying respirators are appropriate only for ammonia and certain amines (usually the same cartridge, check manufacturer's specifications). Other alkaline compounds such as stibine, phosphine and arsine (all hydrides) require the use of supplied air systems.

3. **Mercury Vapor**. A specialized cartridge is available to protect wearers against mercury vapors.

4. **Organic** (organic vapors, OV). Compounds that are composed of carbon and hydrogen. These include aliphatic hydrocarbons, alcohols, ethers, ketones, organic acids, nitriles, amines, aldehydes, aromatics, and cyclic ethers and epoxides. In the various groups, there may be compounds for which OV cartridges are satisfactory and ones which necessitate the use of supplied air equipment. Care must be exercised in selecting the proper protection.

Organic compounds also encompass halogenated organics (1,1,1-trichloroethane, chloroform, carbon tetrachloride), amides (formamide) and isocyanates (toluene diisocyanate). Many of these compounds have poor warning properties and thus, OV cartridges are unacceptable or extremely limited in protection capacity.

Organic Groups	Use Air-Purifying For:	Use Supplied Air For:
Aliphatics, Saturated	Octane n-Hexane Nonane	Methane (simple asphyxiant) Butane (poor warning properties)
Alcohols and Ethers	n-Butyl alcohol [†] Ethyl alcohol Isopropyl alcohol [†] Isopropyl ether n-Propyl alcohol [%]	Allyl alcohol Dimethyl ether (very short OV service life) Methanol (poor warning properties)
Ketones	Acetone Methyl ethyl ketone [*] Methyl isobutyl ketone [*]	Chloroacetone (warning unknown) Dipropyl ketone (warning unknown)
Organic Acids	Acetic acid [†] Chlorosulfonic acid [†] Propionic acid [†]	Formic acid (questionable warning)
Nitriles	Acetonitrile	Acrylonitrile (poor warning) Methylacrylonitrile
Amines	Methylamine Butylamine Ethanolamine Ethylamine [†]	Diethylene triamine (warning unknown) Ethyleneimine (poor warning) Triethanolamine
Aldehydes	Crotonaldehyde [†] Formaldehyde [#] Glutaraldehyde [%]	Acetaldehyde (short OV service life) Acrolein
Aromatics	Benzene [§] Naphthalene [%] Nitrobenzene Pyridine Quinoline Toluene Xylene	Aniline (questionable warning) Benzoyl chloride Picoline o-, m-, and p-Toluidine
Cyclic Ethers and Epoxides	Tetrahydrofuran	Propylene oxide (short service life for cartridge) Dioxane Ethylene oxide Epichlorohydrin

* Full-face respirator is recommended.

A cartridge specifically rated for formaldehyde MUST be used.

§ Supplied air is recommended due to poor warning properties; however, OSHA allows an air-purifying respirator.

% A cartridge designated for both organic vapors and particulates should be used.

Source: NIOSH Pocket Guide to Chemical Haz., 1997

3M 2000 Respirator Selection Guide

Draeger Respiratory Protection Selection Guide

5. **NIOSH-Prohibited Cartridges.** NIOSH prohibits the use of chemical cartridges for the following chemicals because of their toxicity, poor warning properties, reactivity or other hazardous characteristics:

Acrolein	Hydrogen cyanide	Methylene bisphenyl isocyanate	Phosgene
Aniline	Hydrogen fluoride	Nickel carbonyl	Phosphine
Arsine	Hydrogen selenide	Nitrobenzene	Phosphorus trichloride
Bromine	Hydrogen sulfide	Nitrogen oxides	Stibine
Carbon monoxide	Methanol	Nitroglycerin	Sulfur chloride
Dimethylaniline	Methyl bromide	Nitromethane	Toluene diisocyanate (TDI)
Dimethyl sulfate	Methyl chloride	Ozone	Vinyl chloride

D. Combination Filters. In the event that a worker will be exposed to particulates and gases and vapors, combination cartridges are necessary because neither type is adequate for the other contaminant class (i.e., a particulate filter will not afford protection against gases and vapors).

VI. REQUIRED VERSUS VOLUNTARY USE

A. Distinction Between Types of Use. The OSHA standard makes a distinction between required and voluntary use of respirators. A worker is required to wear a respirator in any workplace where respirators are necessary to protect the worker's health or where the employer has established a policy that respirators are required. In the case of voluntary respirator use, an employer may provide respirators at the request of workers or permit workers to use their own respirators. However, voluntary use is permissible only if the employer determines that a voluntarily worn respirator does not in itself create a health hazard.

B. Voluntary Use Responsibilities. There are two situations of voluntary use:

1. The great majority of voluntary use situations involve filtering facepieces which are provided for the worker's sense of comfort. For example, some individuals with allergies to research mice or rabbits may request a respirator when handling these animals. A worker sweeping a dusty floor may want a filtering facepiece.

If the worker is provided a filtering facepiece, there are some minor requirements for the PI/supervisor to follow.

- Use of the filtering facepiece may not interfere with the worker's ability to work safely.
 - The PI/supervisor must ensure that the filtering facepiece is not dirty or contaminated.
 - The PI/supervisor must provide the wearer with the information presented in Appendix A.
2. In some rare cases, a worker may wish to wear a tight-fitting facepiece with separate filtering elements. If this voluntary practice is permitted, there are additional requirements.
 - The PI/supervisor must determine that the worker is medically able to wear the respirator. The respirator may not adversely affect the wearer's health. A medical evaluation is a prerequisite to use.
 - The employer must ensure that the respirator is maintained in proper condition. This is essential to prevent exposure to contaminants that accidentally may have soiled the interior of the respirator and to avoid skin irritation and dermatitis associated with use of an unclean respirator. See sections VIII and IX for cleaning, disinfecting, and storage requirements.
 - Apply any other respiratory program rules necessary to guarantee that the wearer is not harmed.

VII. PROPER USE OF RESPIRATORS

A. Foundations of Proper Use. There are three primary rules the PI/supervisor must enforce to ensure the correct and effective use of respirators.

1. Prohibit conditions that may result in facepiece seal leakage.
2. Prevent workers from removing the respirators in hazardous environments.
3. Take action to achieve continued efficient respirator operation during the work shift.

B. Impediments to Facepiece Seal Protection. Do not permit tight-fitting facepieces to be worn by workers with:

1. facial hair that comes between the sealing surface of the facepiece and the face or that interferes with valve function
2. any condition that interferes with the facepiece-to-face seal or valve function
3. corrective glasses or goggles or other personal protective equipment that could interfere with the facepiece-to-face seal.

C. User Seal Check. The individual who will be using a tight-fitting facepiece must perform a user seal check to demonstrate that an adequate seal is achieved each time the respirator is put on. The user shall follow the positive and negative pressure checks listed below or the respirator manufacturer's recommended user seal check method prior to entering a hazardous atmosphere with the respirator. If you choose to adopt the manufacturer's procedures, you must prove that this method is equally as effective as the pressure checks explained here.

1. **Positive Pressure Check.**
 - a) Close off the exhalation valve by lightly placing a palm over the exhalation cover. For many respirators, this method of leak testing requires the wearer to first remove the exhalation valve cover before blocking off the exhalation valve. The cover is then replaced after the test.
 - b) Gently exhale into the respirator and create a slight positive pressure.

- c) Once you feel pressure in the facepiece, use your free hand to check around the outer fringes of the facepiece for leakage.
 - d) Do you detect an opening? If so, the respirator must be readjusted to seal more firmly to your face. The positive pressure check is repeated until the build-up of a slight positive pressure inside the respirator is not accompanied by outward leakage.
2. **Negative Pressure Check.**
- a) Close off the inlet opening for the filter, cartridge or canister. This is done by covering the opening with the palms of your hands or by replacing the filter seals. The design of the inlet opening of some cartridges cannot be covered effectively with the palm of the hand. The test can also be performed by covering the inlet opening with a thin latex or nitrile glove or a piece of paper.
 - b) Inhale gently so that the facepiece collapses slightly and hold your breath for approximately 10 seconds.
 - c) As the facepiece remains slightly collapsed toward your face, pay attention to any potential leaks. You should not detect any inward leakage of air into the respirator if the seal is satisfactory.
 - d) Do you detect a leak? If so, the respirator and/or the harness straps must be readjusted to seal the facepiece more firmly to your face. The negative pressure check is repeated until no leakage is perceived.
3. **An adequate fit MUST be achieved before the wearer may enter a hazardous atmosphere!** The user seal checks are not a substitute for the yearly fit test.

D. Continuing Respirator Effectiveness. On an ongoing basis, the PI/supervisor is responsible for evaluating the continued effectiveness of the respirators.

1. Maintain surveillance over the work area conditions and worker exposure and stress.
2. Allow respirator wearers to leave the work area:
 - to wash their faces and facepieces as necessary to prevent eye or skin irritation associated with respirator use
 - if they detect vapor or gas breakthrough, changes in breathing resistance, or leakage of the respirator
 - to replace the respirator or the filter, cartridge, or canister elements
3. If a worker detects vapor or gas breakthrough, changes in breathing resistance, or leakage of the facepiece, replace the respirator before allowing the worker to return to the work area.

VIII. CLEANING AND DISINFECTING

The respirator provided to a potential wearer must be “*clean, sanitary, and in good working order.*” The following procedures are required to clean and disinfect respirators, unless the respirator manufacturer recommends another method which is proven to be equally effective. The PI/supervisor must maintain documentation that confirms that the manufacturer’s procedures are as satisfactory as those given by OSHA. The methods utilized for cleaning and disinfecting must not cause damage to the respirator or harm to the user.

A. Cleaning Schedule.

1. A respirator issued for the exclusive use of one worker is to be cleaned and disinfected as often as necessary to be maintained in sanitary condition.
2. Respirators issued to more than one worker are to be cleaned and disinfected before being worn by different individuals.

B. Cleaning Procedures.

1. Remove filters, cartridges, or canisters. Disassemble the facepiece to the extent instructed by the manufacturer. Discard or repair defective parts.
2. Wash components in warm (maximum 110° F) water with a mild detergent or with a cleaner proposed by the manufacturer. A stiff bristle (not wire) brush may be used to facilitate the removal of dirt.
3. Rinse components thoroughly in clean, warm, preferably running water. Drain.
4. If the cleaner does not contain a disinfecting agent, immerse the respirator components in one of the disinfectants listed below for at least two minutes.
 - hypochlorite solution (50 ppm chlorine)
 - aqueous solution of iodine (50 ppm)
 - other disinfectants approved by the manufacturer that are equally potent
5. Repeat step 3 if step 4 was implemented.

6. Air-dry or hand-dry with a clean lint-free cloth.
7. Reassemble the facepiece, replacing the filtering elements.
8. Test the respirator to verify that all components work properly.

The importance of thorough respirator 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.**

IX. STORAGE AND INSPECTION

All respirators must be properly stored to protect them from damage, contamination, dust, sunlight, extreme temperatures, excessive moisture, and disintegrating chemicals. Pack and store respirators to prevent deformation of the facepiece and exhalation valve.

A. Basic Inspection Before Each Use. All respirators used in routine situations shall be inspected prior to each use and during cleaning. The inspection must include the following points:

1. Check respirator function, tightness of connections, and the condition of the various parts (e.g., facepiece, head straps, valves, filtering elements).
2. Check elastomeric parts for pliability and signs of deterioration.

B. Identification of Filters, Cartridges, and Canisters.

1. Ensure that all filters, cartridges, and canisters used in the workplace are labeled and color coded with the NIOSH approval label. The label must not be removed and must remain legible.
2. The air-purifying element must be appropriate for the form of the contaminant to which the worker is exposed. A filter designed to remove particulates would not be adequate for protection against gases and vapors.
3. Identify and adhere to the end-of-service-life of the filtering element. See section C below.
4. Do not allow interchange of filters between brands of respirators. For example, a Scott respirator is only certified by NIOSH when used in conjunction with filters manufactured by Scott. A 3M filter on a Scott respirator would violate the NIOSH approval conditions.

C. Filter Service Life. Filters intended for removal of gases and vapors may be equipped with NIOSH-approved end-of-service-life indicators (ESLIs) warning that the sorbent is approaching saturation and is no longer effective.

For filters without ESLIs, the employer must enforce a sorbent change schedule based on reliable information and service life of the cartridges and canisters available in the workplace. The respirator manufacturer or chemical supplier should be able to provide guidance for developing the filter change schedule.

If the manufacturer cannot provide data, information, mathematical models, or suggestions to support the use of the given filter against the contaminants in your workplace, you must use atmosphere-supplying respirators.

D. Routine Inspection and Maintenance Checklist.

Before wearing the respirator, always follow these steps:

1. Inspect the facepiece.
 - There should be no cracks or pits in the sealing edge. The facepiece should not be distorted or deformed in any way.
 - Rubber or elastomeric parts must be inspected for pliability and signs of deterioration. Stretching and manipulating rubber or elastomeric parts with a massaging action will keep them flexible and supple and will prevent them from assuming a deformed shape during storage.
2. Check the cartridge holders.
 - The cartridge holders should be securely attached to the facepiece. A good seal will prevent leakage of contaminants into the respirator.
 - The threads on the inside of the holder should not be chipped or cracked.
 - The rubber gasket must be firmly in place.

3. Locate the inhalation valve.
 - The valve must be in place and in good condition. The user should ensure that it can be moved freely. A torn or warped valve should be replaced. A quick and easy test to establish the condition of the valve is to remove it and lay it on a flat surface. If the valve buckles and a wave in the rubber is noticeable, the valve must be discarded.
4. Locate the exhalation valve.
 - Check the cover of the exhalation valve for cracks or splits.
 - Remove the cover to inspect the valve itself. The valve should be free of tears. Stretch the rubber and look for pinholes.
 - Check the valve seat for scratches, holes or pits. There should be no foreign material on the seat and the valve must lie flat against it.
 - The cover should be able to spin freely over the valve.
5. Examine the head harness and buckles.
 - The serrations on the straps of the head harness should not be worn or smooth.
 - The buckles must work properly. They should not be bent.
6. Choose the appropriate air-purifying element.
 - Is the air-purifying element designed to protect the wearer against the expected hazards? Verify that the element will remove the contaminants present in the environment in which the wearer is working.
 - The air-purifying element should not be used if it is dented or deformed.
 - It must be screwed tightly into position.

In addition, for **full-face respirators**:

7. Check the lens and the lens ring.
 - There should be no marks on the lens that would hinder vision.
 - The lens should not be marred with cracks or pits.
 - The lens should be seated properly in the facepiece.
 - There should be no gaps or bulges in the rubber around the lens. Both halves of the lens ring should be present and tightly fitted to one another.
8. Inspect the speaker diaphragm.
 - The grille on the speaker diaphragm should be located on the upper half of the unit, closest to the lens ring.
 - The diaphragm should not be cracked.
 - It must be held fast by a clamp. The adjuster screw securing the clamp should be in the five o'clock position.

When wearing the respirator, if a peculiar taste or odor can be noticed, the air-purifying element must be replaced. If the wearer encounters difficulty breathing, the air-purifying element should be replaced as well. In general, it is wise to keep track of hours of use for air-purifying elements since you must discard them in accordance with the filter change schedule. Be aware that certain cartridges are harmed by conditions of high humidity or excess dryness.

X. REQUIRED TRAINING

Before using a respirator, a worker shall be informed about the various types available and the conditions under which the respirator should be used. All instructions and cautions provided through worker training and the written respiratory program must be strictly followed. All users should become familiar with the OSHA standard and information about the contaminants present.

1. **Required Use.** Before wearing a respirator, each worker who is required under the standard or by the PI/supervisor to wear a respirator should be provided:
 - the reasons why they need respiratory protection
 - the nature, extent, and effects of respiratory hazards to which they may be exposed
 - an explanation of why engineering controls are not being applied or are not adequate and what effort is being made to reduce or eliminate the need for respirators
 - an explanation of why a particular type of respirator has been selected for a specific hazard
 - an explanation of the operation, capabilities and limitations of the respirator selected
 - instruction in inspecting, donning, checking the fit of, and wearing the respirator
 - an opportunity for each respirator wearer to handle the respirator, learn how to don and wear it properly, check its seals, wear it in a safe atmosphere, and wear it in a test atmosphere
 - an explanation of proper maintenance and storage

- instruction in how to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions
 - instructions in how to recognize the medical signs and symptoms that may limit or prevent the effective use of respirators
 - an explanation of the general requirements of the OSHA standard for respiratory protection.
2. **Voluntary Use.** Workers who voluntarily wear a respirator and who are not required by their PI/supervisor or the OSHA standard to wear a respirator must receive the basic advisory information on respirators provided in Appendix A.
3. **Retraining/Special Training.** Respirator users should be retrained annually, and when the following situations occur:
- changes in the workplace or the type of respirator render previous training obsolete
 - inadequacies in the worker's knowledge or use of the respirator indicate that the worker has not retained the requisite understanding or skill, or
 - any other situation arises in which retraining appears necessary to ensure safe respirator use

APPENDIX A

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 PI/supervisor 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 respirator's limitations.
2. Choose respirators certified for use to protect against the contaminant of concern. The National Institute for Occupational Safety and Health (NIOSH) 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.

APPENDIX B

MEDICAL EVALUATION FOR RESPIRATOR USE

Name of respirator wearer: _____
Social Security Number: _____ Date of birth: _____
Principal Investigator: _____ Department: _____

Respirator(s) to be worn (✓all that apply):

- Required-use disposable respirator (filter-mask, non-cartridge type only) — Voluntary use does not require a medical evaluation.
- Half-facepiece type negative-pressure air-purifying
- Full-facepiece type negative-pressure air-purifying
- Powered air-purifying (PAPR)
- Self-contained breathing apparatus (SCBA)

Extent of usage (✓all that apply):

- Escape only (no rescue)
- Emergency rescue only
- Less than 5 hours per week
- Less than 2 hours per day
- 2 to 4 hours per day
- Over 4 hours per day

Describe the nature of work to be performed:

Level of work effort (✓the one that best applies):

- Light** (less than 200 kcal per hour)
Examples of a light work effort are sitting while writing, typing, drafting, or performing light assembly work; or controlling machines
- Moderate** (200 to 350 kcal per hour)
Examples of moderate work effort are sitting while nailing or filing; 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
- Heavy** (above 350 kcal per hour)
Examples of heavy work are lifting a heavy load (about 50 lbs.) from the floor to your waist or shoulder; shoveling; walking up an 8-degree grade about 2 mph; climbing stairs with a heavy load (about 50 lbs.)

Describe if there are special work conditions (i.e., hazardous materials, protective clothing, temperature and humidity extremes)

Principal Investigator/Supervisor

Principal Investigator's/Supervisor's Signature

Date

PHYSICIAN'S EVALUATION

Physician's name: _____
Address: _____
Phone number: _____

The intended respirator wearer was / was not (please circle) found to be physically able to wear the described respirator while performing the described work.

Medical Evaluation (✓all that apply):

- No restrictions on respirator use
- Some specific use restrictions
- No respirator use permitted

Restrictions

Physician

Physician's Signature

Date

Northwestern University – Office of Research Safety

Return a **copy** of this form to the **Office of Research Safety -**

Technological Institute NG-71
Mail Code: 3121
2145 Sheridan Road
Evanston, IL 60208-3121
(847) 491-5581
Fax (847) 467-2797

APPENDIX C

OSHA RESPIRATOR MEDICAL EVALUATION QUESTIONNAIRE

Adapted from Appendix C of the OSHA Standard for Respiratory Protection, 29 CFR 1910.134.

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) Question 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 (fits): 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: _____)
- Eye irritation: Yes / No
 - Skin allergies or rashes: Yes / No
 - Anxiety: Yes / No
 - General weakness or fatigue: Yes / No
 - 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?
- Wear contact lenses: Yes / No
 - Wear glasses: Yes / No
 - Color blind: Yes / No
 - 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?
- Difficulty hearing: Yes / No
 - Wear a hearing aid: Yes / No
 - 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?
- Weakness in any of your arms, hands, legs, or feet: Yes / No
 - Back pain: Yes / No
 - Difficulty fully moving your arms and legs: Yes / No
 - Pain or stiffness when you lean forward or backward at the waist: Yes / No
 - Difficulty fully moving your head up or down: Yes / No
 - Difficulty fully moving your head side to side: Yes / No
 - Difficulty bending at your knees: Yes / No
 - Difficulty squatting to the ground: Yes / No
 - Climbing a flight of stairs or a ladder carrying more than 25 lbs: Yes / No
 - 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 feeling 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): _____