

**MEDICAL UNIVERSITY OF SOUTH CAROLINA (MUSC)**  
**RESPIRATORY PROTECTION PROGRAM POLICY**

**Revised: 9/2007**

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## **INTRODUCTION**

The Medical University of South Carolina has adopted the philosophy that respiratory protective equipment is to be used as a "last resort" type of protection. Exhaust ventilation or other control measures will be utilized whenever possible. However, there will be occasions when these controls are not feasible or when respirators are required in addition to engineering controls. Therefore, we have established a MUSC Respiratory Protection Program.

The purpose of our Respiratory Protection Program is to eliminate occupational illness that may be caused by inhalation of dusts, fumes, mists, aerosols, smoke, Tuberculosis, vapors, gases or a combination of hazardous materials. To ensure consistency in coordination and direction, the Occupational Safety and Health Division's Environmental Health Manager (laboratory safety) will have the responsibility of administering this program, and ensuring that all aspects of the program are complied with.

## RESPIRATORY HAZARDS

Toxic materials can enter the body three ways: through the gastrointestinal tract, the skin, and the lungs. Of these three ways for toxic materials to enter the body, the lungs are of greatest concern. Because the lungs furnish the circulatory system with oxygen, toxic materials can be spread throughout the body by entering through the lungs. The purpose of this section is to list the different groups of respiratory hazards, which may be encountered at MUSC.

There are three basic categories of Respiratory Hazards:

- A) Oxygen Deficiency
- B) Gas/Vapor
- C) Particulate Contaminants
- D) Combination gas/vapor and particulate

### A. Oxygen Deficiency

The normal content of oxygen in air is 20% by volume. Oxygen concentrations below 19.5% are considered unsafe because they cause problems with coordination, mental processes, and other body functions. Low oxygen levels can cause death within minutes. Oxygen levels that are between 19.5% and 16.5% are considered "Oxygen Deficient," but are not immediately dangerous to life or health. Any levels below 16.5% are considered "Oxygen Deficient" and are immediately dangerous to life and health. This hazard group involves areas where there is not enough oxygen to sustain life. Some examples include areas where oxygen has been displaced by smoke, areas where an activated CO<sub>2</sub> fire protection system displaces the oxygen in the atmosphere, areas where dangerous concentrations of toxic vapors are present (chemical spills, leaking tanks, etc.), and confined spaces such as manholes and tanks.

B. Gas/Vapor Contaminants

Gas and vapor contaminants can have adverse effects on the body in two ways:

1. By reacting with the lung tissue causing pulmonary edema and by directly interfering with the gas transfer functions of the lungs.
2. By passing into the blood stream affecting other body organs or by prohibiting the blood from providing a sufficient amount of oxygen to body organs.

This hazard group includes, but is not limited to, toxic chemicals such as caustic acid, ethylene oxide, formica glue, formaldehyde and Chlorine.

C. Particulate Contaminants

When considering particulate matter, the size of the particle is an important factor. Particles 10 microns or larger generally do not pose as much of a hazard as smaller particles. Larger particles cannot get into the deeper spaces of the lungs. Particulate contaminants include materials such as wool dust, wood fibers, cloth lint, asbestos, silica dust, spray painting, welding fumes and tuberculosis aerosols.

### **CONTROL OF HAZARDS**

Hazard control should start at the source. This is feasible when working in a controlled environment such as laboratories where chemicals can be isolated by the use of fume hoods or substitutions can be made. Sometimes it is impossible to use engineering controls to eliminate the hazard; therefore, respiratory devices will be made available as needed in these cases. When working with patients that are known or suspected of having tuberculosis, OSHA requires respiratory protection in addition to engineering controls.

### **RESPIRATORY EQUIPMENT**

The three major categories of respiratory devices are Air-Purifying, Supply Air and Self-Contained.

Air-Purifying Respirators include mechanical filter respirators, which protect against dust, mist, fumes and aerosols. These respirators have a face piece with mechanical cartridges, which remove harmful particles as air is pulled through the cartridge. Mechanical filters are efficient for removing particles but offer no protection against gases, vapors or oxygen deficiency. Chemical cartridge respirators protect against specific vapors and gases. These respirators use cartridges, which contain chemicals that remove harmful gases and vapor. There are four limitations, which apply to chemical respirators:

1. Do not use a chemical respirator for protection against chemicals, which are extremely toxic in small concentrations. Example: Hydrogen cyanide.
2. Do not use a chemical respirator for protection against hazardous chemicals, which have high odor threshold levels. Example: Methylene chloride.
3. Do not use a chemical respirator for protection against hazardous chemicals, which are highly irritating to the eyes.
4. Do not use a chemical respirator in oxygen deficient atmospheres.
5. Use chemical cartridges that are specific to the chemical being used.

Combination mechanical and chemical cartridge respirators are used for areas where one might be exposed to both particulates and chemical vapors.

Supply Air Respirators are connected to a compressed air source by a hose and air is delivered to the user continuously in sufficient volumes to meet the wearer's breathing requirements. We do not use this type of respiratory protection at MUSC at this time.

A self-contained Breathing Apparatus is a type of respiratory equipment, which can be used in oxygen deficient atmospheres and areas where there are high concentrations of toxic gases. Most self-contained breathing apparatus supply up to thirty (30) minutes of air. They are equipped with an audible alarm that sounds when five (5) minutes of breathing air remains. When the alarm

sounds, the user should leave the area. Since this type of respirator will generally be used in dangerous atmospheres, there should be another person with the same equipment accompanying the user in case the user needs aid. Additionally, use of a tending line should be considered.

Respirators are distributed by MUSC's Occupational Safety and Health Division with the following considerations: type of hazard (vapor, gas, particulate, etc.), level of hazardous material in work areas, working conditions (hot, cold, underground, etc.) and the quality and limitations of the respirator.

The following are examples of the jobs at MUSC that require respiratory protective equipment and the type of respirators to be used. All respirators purchased by MUSC will have a National Institute of Occupational Safety and Health (NIOSH) approval.

| <b>JOB</b>   | <b>TYPE OF RESPIRATOR USED</b>  |
|--|---|
| Use of muriatic acid   | Half-face, air purifying respirator (organic vapor/acid gas)  |
| Use of caustic acid  | Half-face, air purifying respirator (organic vapor/acid gas)  |
| Changing of ethylene oxide tanks   | Full-face, air purifying gas canister respirator (type GEMO-SSW).                                       |
| Ethylene oxide leaks   | Full-face, self contained breathing apparatus is required for emergency entry.                          |
| Applying formica glue  | Half-face, air purifying organic vapor respirator.  |
| Cleaning of electrical equipment with gamlin                                 | Half-face, air purifying gas organic vapor respirator.  |
| Changing Chlorine cylinder   | Full-face, self-contained breathing apparatus is required for emergency entry.                          |
| Working around asbestos removing small quantities of asbestos                | Half-face, air purifying chemical cartridge respirator for dust, mist and fumes not to exceed 0.1 f/cc. |
| Spray or brush painting  | Half-face, air purifying chemical cartridge for specific pesticides operation.                          |
| Pesticides Spraying  | Half-face, air purifying chemical cartridge for specific pesticides operation.                          |
| Mercury spills larger than the size of quarter                               | Air-purifying chemical cartridge respirator.  |
| Welding galvanized material in areas of poor ventilation or confined spaces. | Half-face, air purifying in chemical cartridge respirator with high efficiency particulate cartridge.   |

| <b>JOB</b>   | <b>TYPE OF RESPIRATOR USED</b>   |
|--|--|
| Chemotherapy drug spills   | Half-face, air purifying mechanical cartridge respirator with high efficiency particulate cartridge. |
| Work on fume hood exhaust  | Full-face, air purifying respirator with combination HEPA/organic vapor cartridge.                   |
| Work in restricted roof zones  | Half-face, air purifying respirator with combination HEPA/organic vapor cartridge.                   |
| Work in an enclosed area with a suspect or confirmed tuberculosis patient (patient room, EMS vehicle). | Tecnol-N-95 disposable HEPA. filtered respirator or powered air purifying respirator (PAPR).         |
| Performing autopsies on suspect (PAPR) or confirmed tuberculosis patients.                             | Tecnol-N-95, powered air purifying respirator.   |
| Work with chemical and biological exposures (Emergency Response Team Only)                             | 3M Breathe Easy Butyl Rubber Hood, powered air purifying respirator (PAPR).                          |
| BSL3 Infectious agents   | Biomedical device, Maxair Premier Hood System, powered air purifying respirator (PAPR).              |

### **RESPIRATORY TESTING**

All employees who intend to wear a respirator must be medically approved before receiving a respirator. Employee Health Services will perform pulmonary lung function testing to determine if employees have the lung capacity to work and wear a respirator. Employees wearing the Tecnol N-95 respirator for working with suspect or confirmed TB patients will only be required to complete a medical questionnaire. Formal fit testing will be conducted by MUSC's Occupational Safety and Health Division. Facial hair lying between the sealing surface of a respirator face-piece and the wearer's skin will prevent a good seal. Therefore, employees with facial hair such as sideburns, beards or mustaches, which protrude into the sealing surface of the respirator, will be refused initial fitting and prohibited from using a previously fitted respirator. Employees wearing a powered air-purifying respirator specifically designed for employees working with suspect or confirmed tuberculosis patients will not be required to pass a formal fit test. Supervisors will be responsible for prohibiting their employees from wearing a respirator unless they have satisfactorily completed a

formal fit testing and continue to meet the facial hair limitations. Employees not wearing a respirator when hazardous operations require the use of a respirator will receive disciplinary action, which can result in termination.

The following are formal fit-testing procedures:

1. Respirators will be equipped with high-efficiency particulate cartridges.
2. Employee will put on respirator and wear it for 10 minutes before starting fit-test.
3. Employees will be advised that the test smoke may be irritating to their eyes and to keep their eyes closed while being tested.
4. The employee will sit inside a plastic bag enclosure.
5. The individual giving the fit-test will instruct the respirator wearer to breathe normally for 60 seconds while injecting irritant smoke around the sealing surface of the respirator. If no leakage is detected, the tester will ask the wearer to do light exercise like turning his/her head, walking in place and talking for an additional 60 seconds. If any leakage is indicated, the test will be canceled. At this time, the respirator will be inspected for defects. If leakage occurs again, a different brand or size respirator will be tried.

Every MUSC employee who is required to wear a respirator will be given instructions on how the respirator should be worn, how to adjust it and how to determine if it fits correctly during normal fit checking. Before an employee enters a hazardous area, he/she must perform two checks to assure a proper fit:

Employees shall perform a user seal check each time they put on a tight fitting respirator using the following procedures.

User seal check is defined as “an action conducted by the respirator used to determine if the respirator is properly sealed to the face. Such a check is performed by the user each time the respirator is donned or adjusted to ensure that the tight fitted respirator is properly sealed on the users face, i.e., that the proper seal has been achieved.

### **INSPECTION, MAINTENANCE AND REPAIR OF RESPIRATORS**

A very important part of our respiratory protection program is inspection, maintenance and repair of equipment. An inspection by the respirator wearer should be made before and after using the respirator. Inspections should be performed on respirators on a monthly basis even if it has not been used routinely.

Inspections shall include a check of the tightness of connections between the face-piece, headbands, valves, connecting tubes, and canister. Rubber or elastic parts shall be inspected for pliability and signs of deterioration. Stretching and manipulating rubber parts with a massaging action will keep them pliable and flexible. To ensure that these inspections take place, the supervisor is responsible for keeping records of the monthly inspections. Records shall include the date of inspection and general condition of the respirator. After using a respirator, the wearer shall clean the respirator with a isopropanol wipe pad (contains 70% isopropanol). If a respirator shows signs of wear or has defective parts, it will be turned into the Occupational Safety and Health Division. When storing a respirator, place it in the original plastic bag and box to protect it against dust and sunlight. Also, avoid storing a respirator in extreme heat or cold and excessive moisture. Tecno N-95 respirators are to be used for one shift only. At the end of shift discard-retrieve new one at beginning of shift.

## **MEDICAL SURVEILLANCE**

On a yearly basis, every employee required to wear a respirator will be provided an occupational health physical conducted by Employee Health Services. The purpose of this physical is to determine if the employee is medically capable of wearing a respirator and to establish a health baseline for comparison in future years. Pulmonary lung function testing, to include forced vital capacity and forced expiratory volume at one second, will be performed as well as any other tests deemed appropriate by the examining physician. \*Employees using disposable respirators for protection against tuberculosis will only complete a medical questionnaire designed by Health Services.

## **TRAINING**

It is important that all employees and their supervisors whose job description requires the use of respiratory protection be instructed on the proper use and limitations of the respirators. The Occupational Safety and Health Administration requires all employees be trained in the proper use of the respirator assigned to them. Areas that will be covered in respirator training include:

- a. An explanation of the respiratory hazard and what happens if the respirator is not used properly.
- b. An explanation of why engineering controls are not used and why respirators are needed for protection.
- c. An explanation of why a particular type of respirator has been selected.
- d. Capabilities and limitations of selected respirators.
- e. An explanation of how to wear and how to check for fit and operation.
- f. Instructions on maintenance.
- g. A fit-testing procedure.

## DUST MASK

Negative pressure particular respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium.

12CFR84-Filter classification/Filtering Efficiency Level.

N-95%

R-99%

P-99.97%

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 respirators 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.
3. Keep track of your respirator so that you do not mistakenly use someone else's respirator.