Department of Environmental Health and Safety & Emergency Management

Subject: Respiratory Protection		
Date: April 2013	**Revision: 02**	**Page: 1 of 19**

SUMMARY:

The Respiratory Protection Guideline provides the University of Michigan-Dearborn (UM-Dearborn) community with the necessary information to understand respiratory protection requirements and the means to obtain proper respiratory protection from the Department of Environmental Health and Safety & Emergency Management (EHSEM). The reliability of any respirator is dependent on proper selection, training, medical screening, and respirator maintenance. Therefore, University employees must obtain all respiratory devices through EHSEM. Filtering facepieces (i.e. Dust Masks) used for nuisance dust activities can be obtained through EHSEM.

SCOPE:

This guideline applies to all University employees that utilize respiratory protection. Currently, Supplied-Air Respirator (SAR) and Self-Contained Breathing Apparatus (SCBA) are not utilized at UM-Dearborn.

Employee protection from occupational diseases caused by breathing air contaminated with harmful dusts, fumes, sprays, mists, fogs, smokes, vapors, gases, or radioactive material is best achieved by prevention of atmospheric contamination through the use of engineering control measures (e.g. enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials).

MIOSHA regulations specify that compliance with the Permissible Exposure Limits (PELs) of potentially hazardous substances **MAY NOT** be accomplished through the use of respirators except:

1) during the period necessary to install engineering controls;

2) in situations where engineering controls are either not feasible or are insufficient to reduce the airborne concentration of a potentially hazardous substance below the specified PEL; and

3) in emergency situations. Approved respirators must be made available and used only when it is not possible or practical to use or maintain engineering controls.

REFERENCE REGULATIONS:

Respiratory Protection Standard (29 CFR 1910.134, Michigan R 3502)
Respiratory Protection and Controls to Restrict Internal Exposure in Restricted Areas (10 CFR 20/Subpart H)

DEFINITIONS:

Air Purifying Respirator (APR) – 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) - Means 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 regulations.

Atmosphere-Supplying Respirator – A respirator that supplies the user with breathing air from a source independent of the ambient atmosphere, and includes supplied-air respirators (SARs) and self-contained breathing apparatus (SCBA) units.

Authorized Users of SCBA - Persons who have been medically certified to wear SCBA units and have received training in the use and maintenance of SCBA equipment as per this Guideline.

Breakthrough - The penetration of challenge material/s through a gas or a vapor air-purifying element. The quantity or extent of breakthrough during service life testing is often referred to as the percentage of the input concentration.

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

CBRN – Chemical, biological, radiological, and nuclear agents that NIOSH has certified some respirators for protection from.

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.

End-of-Service-Life – A negative pressure particulate respirator with a filter as the integral part of the facepiece or entirely composing the facepiece that is commonly known as a “dusk mask” (see definition above). Filtering facepieces are available through EHSEM or purchased through M-marketsite.

Filtering Facepiece **–** A negative pressure particulate respirator with a filter as the integral part of the facepiece or entirely composing the facepiece that is commonly known as “dust masks.” Filtering facepieces are available through EHSEM or purchased through M Stores.

Fit Factor (FF) – is a number that is the direct result of a quantitative respirator fit test. It is a measurement made by an instrument during a simulation of workplace activities (the exercises). It is expressed as the challenge aerosol concentration outside the respirator divided by the challenge aerosol concentration that leaks inside the respirator DURING A FIT TEST.

Fit Test – Means the use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual. (Also, see Qualitative fit test-QLFT and Quantitative fit test-QNFT).

High Efficiency Particulate Filters (*HEPA)* - Filters capable of trapping and retaining at least 99.97% of all particles of 0.3 micrometers in diameter.

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.

Maximum Use Concentration (MUC) – Means 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 (APF) of the respirator or class of respirators and the exposure limit of the hazardous substance. (The MUC can be determined mathematically by multiplying the APF specified for a respirator by the required MIOSHA permissible exposure limit, short-term exposure limit, or ceiling limit. When no MIOSHA exposure limit is available for a hazardous substance, an employer must determine an MUC on the basis of relevant available information and informed professional judgment).

National Institute of Occupational Safety and Health (*NIOSH)* - A research group within the U.S. Department of Health and Human Services. NIOSH is an agency that was established to help assure safe and healthful working conditions for working men and women by providing research, information, education, and training in the field of occupational safety and health. NIOSH is the responsible organization for testing and certifying respirators.

Negative Pressure Respirator – A tight-fitting 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 which contains an oxygen partial pressure of less than 148 millimeters of mercury (19.5% by volume) at sea level.

Powered Air-Purifying Respirator (*PAPR)* – An air-purifying respirator that uses a blower to deliver air through the air-purifying element to the wearer's breathing zone.

Pressure Demand Respirator- A respirator in which the pressure inside the facepiece in relation to the immediate environment is positive during both inhalation and exhalation.

Program Administrator – Person who is qualified by appropriate training or experience that is commensurate with the complexity of the program to administer or oversee the respiratory protection program and conduct the required evaluations of the program's effectiveness.

Physician or other licensed health care professional (PLHCP) – An individual whose legally permitted scope of practice (e.g. 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 at the site.

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

Quantitative Fit Test (QNFT) – Means an assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.

Respirator - device worn by an individual that is intended to provide respiratory protection against inhalation of airborne contaminants or oxygen deficient air. All respirators must be certified by NIOSH.

Supplied-Air Respirator (SAR) - An atmosphere-supplying respirator in which the source of breathing air in not designed to be carried by the user.

Self-Contained Breathing Apparatus (SCBA) - An atmosphere-supplying respirator in which the source of air is contained with the respirator independent of any other source.

Service Life – The length of time required for an air-purifying element to reach a specific effluent concentration. Service life is determined by the type of substance being removed, the concentration of the substance, the ambient temperature, the specific element being tested (cartridge or

canister), the flow rate resistance, and the selected breakthrough value. The service life for a self-contained breathing apparatus (SCBA) is the period of time, as determined by MIOSH certification tests, in which adequate breathing gas is supplied.

RESPONSIBLITY:

Environmental Health and Safety & Emergency Management

Document and administer the respirator program.

Assess the degree of hazard associated with respiratory exposures and the need for respiratory equipment as requested by employees supervisor/ Principal Investigator (PI).

Coordinate respirator purchasing, disbursement, fit testing and training.

Provide technical assistance upon request.

Evaluate and recommend cartridge change out schedules as requested by employees supervisor/PI.

Schedule and maintain records of all medical surveillance services.

Review and revise the Respirator Protection Program/Guideline including the assurance that the necessary program evaluations are performed as necessary.

Identify a Program Administrator.

Program Administrator

Establish respiratory protection policies, overseeing required evaluations of program effectiveness, and for coordinating the overall respirator protection program.

The current Respirator Program Administrator is Laura L. Drabczyk, EHSEM Director, (3-4914).

Supervisor/PI

Identify jobs requiring respiratory protection and informing their employees of these requirements.

Notify EHSEM of jobs requiring respiratory protection and associated hazards. The program administrator will determine the appropriate cartridge and/or filters needed. The type and amount of cartridges and/or filters issued shall be tracked by the Supervisor/PI.

Assure employees are issued respiratory protection through the procedures outlined in this guideline as well as ensuring that all employees engaged in such work use the appropriate respirators when required, and for ensuring that their employees follow the elements of this program.

Perform periodic work site inspections to determine whether or not the respirators are still necessary.

Ensure compliance with respirator change-out schedules.

Employees

Wear the appropriate respiratory protective equipment and wear it in the manner in which they were trained.

Report any malfunction of their respirator to their and EHSEM department immediately.

Attend scheduled training, medical surveillance, and fit testing.

PROCEDURES:

GENERAL - The following elements are necessary to comply with the Respiratory Protection Guideline:

a. Hazard determinations and equipment selection
b. Employment status and medical clearance
c. Fit testing and fit checking
d. Maintenance, care, and use of respiratory equipment
e. Assurance of appropriate air quality for air supplying respirators
f. Annual training
g. Program evaluation
h. Recordkeeping

A. *HAZARD DETERMINATION AND EQUIPMENT SELECTION* - A respiratory hazard assessment is required for jobs in which employees may be exposed to breathing air contaminated with harmful levels of dusts, fumes, sprays, mists, fogs, smokes, vapors, gases or radioactive materials in order to ensure selection of appropriate respiratory equipment.

1. Hazard Determination

a. At the request of the employee's supervisor/PI, the Program Administrator, can assist in the determination of the degree

of hazard and the need for respiratory protection. These evaluations are based on the identification of the contaminants, the estimated airborne concentration of the contaminants, the toxicity of the contaminants, the warning properties of the contaminant, and the oxygen content of the atmosphere.

b. Managers, supervisors and/or PI shall contact the Program Administrator prior to any non-routine work that may expose employees to hazardous substances where exposure determinations have not been made. This will allow for the proper evaluation of the job's exposures and the selection of the appropriate level of respiratory protection during and after the evaluation.

2. Equipment Selection

a. For each potential respiratory hazard, a NIOSH approved respirator will be recommended by the Program Administrator appropriate for the hazard involved. These respirator selections will include consultation with the applicable employee(s) and will be based on, but not limited to, the following factors:

i. The nature of the hazardous operation or process

ii. The type of respiratory hazard (including physical properties, physiological effects on the body, concentration of toxic material or airborne radioactivity level, and established IDLH concentration for the material)

iii. The warning properties of the respiratory hazard

iv. The oxygen levels in the work area

v. The period of time for which respiratory protection must be provided and the potential stresses associated with the work activities during usage

vi. The physical characteristics and limitations of the various types of respirators

vii. Respirator protection factors and individual's fit test results

viii. All applicable laws, regulations, and safety reference materials relating to the potential hazard

b. Proper respirator selection depends on the particular work situation and selection should be based on the hazard determination. To ensure proper equipment selection and to ensure that the above listed factors are properly considered, the Program Administrator is encouraged to view Appendix A, the "NIOSH Respirator Decision Logic" selection process. Refer to Appendix L, "MIOSHA Respirator Assigned Protection Factors" and Appendix B "Respirator Equipment Selection Guidance and the NIOSH Respirator Decision Logic Process."

B. *EMPLOYMENT STATUS AND MEDICAL CLEARANCE* - Personnel must meet the criteria for employment status and Medical Surveillance to be included in the respiratory protection program.

1. Employment status: The following personnel are eligible for respiratory protection once Medical Surveillance has been successfully completed:

   a. Faculty
   b. Staff
   c. Teaching Assistants
   d. University paid graduate research assistants (University paid is defined as anyone receiving a University of Michigan paycheck. Payment via grant monies does not qualify as University paid.)
   e. University paid Work Study Students

2. Respiratory protection is not available through EHSEM for individuals not on the University payroll. If other individuals wish to use respirators, EHSEM will provide a list of safety supply companies upon request, but the University, their employees, management, and agents will assume no responsibility to direct, recommend, or training in on the limitations, selection, use or care of any such safety equipment.

3. Medical Surveillance: Using a respirator may place a physiological and/or psychological burden on employees 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 employee.

Therefore, all employees required to wear a respirator (including the required use of dust masks/filtering facepieces) will be medically cleared to do so by a University paid medical provider (U-M Occupational Health Services) prior to initial fit testing.

Employees shall not be assigned to tasks requiring the use of respirators unless it has been determined that they are physically able to perform the work and use the equipment. A PLHCP designated by the University will conduct medical Surveillance. The evaluation can be accomplished by use of a medical questionnaire, by examination or a combination of both. EHSEM works closely with the medical provider to ensure all required information is provided.

4. Initial Medical Evaluation

   a. The following is applicable to all required users of filtering facepieces and any other user of respirators:

      i. The employee's supervisor/PI will contact EHSEM at 3-4914 to inform the Program Administrator that an employee is in need of a respirator. The employee will be sent a questionnaire that must be completed during normal working hours and in a confidential manner and submitted to the clinic at the time of their appointment.

      ii. Based on this medical review, the examining PLHCP will determine whether or not an employee can wear a respirator without physical or psychological risk or may request the employee be scheduled for a physical. The employee will be contacted directly by the clinic to schedule an appoint in this case.

      iii. Approval, non-approval, and any medical restrictions for an employee regarding respirator use will be communicated to EHSEM by means of a PLHCP's written medical opinion that only includes information about any medical limitations on respirator use, the need, if any, for a follow-up exam, and that the employee has been provided with a copy of the physician's written recommendation. EHSEM will maintain a copy of the physician's opinion in the employee's Medical Surveillance file.

5. Additional Medical Evaluations

   a. At the time of the physical, the physician will determine the frequency of any re-evaluations. U-M Occupational Health Services will notify the supervisor/PI when employees are due for re-evaluation.

   b. Additional medical evaluations will also be provided when:

      i. An employee reports medical signs or symptoms that are related to respirator use

      ii. A physician, supervisor/PI, or program administrator informs the employee of the need to be re-evaluated

      iii. Information from the respiratory protection program including observations from fit testing and program evaluation indicates a need for re-evaluation

      iv. A change in workplace conditions that results in substantial physiologic or exposure burden placed upon the employee

6. Medical Surveillance for Voluntary Respirator Use

   a. Those employees that choose to voluntarily wear a respirator other than one that qualifies as a "dust mask" where it is not required will be allowed to do so. They will be provided the same initial medical evaluation as described above. Additional medical evaluations will be provided through the use of the medical questionnaire only. The voluntary use of dust masks does not require the employee to undergo medical surveillance.

7. Those employees whose medical evaluation (initial or otherwise) requires the use of a PAPR rather than allowing the use of a negative pressure air-purifying respirator will be accommodated.

C. *FIT CHECKING AND FIT TESTING* - All individuals required to wear a tight-fitting respirator must be qualitatively or quantitatively fit tested for that particular mask before use and annually thereafter (or when an employee has a radical facial structure change from weight loss or gain, dental changes, scarring, surgery, or other conditions, which interfere wit the seal of the facepiece). The

voluntary use of dust masks/filtering facepieces does not require fit testing.

Additional fit testing will be conducted whenever the employee, supervisor/PI, physician, or Program Administrator makes visual observations of changes in the employee's physical condition that could affect the respirator fit. When an employee has successfully completed medical surveillance, that employee will be scheduled for training and fit testing by EHSEM. The employee and his/her supervisor/PI will be notified of the appointment. EHSEM will review the physician's opinion before conducting the fit test and training.

1. Every manufacturer designs facepieces to fit a broad section of the working population, but no single respirator will fit everyone. EHSEM carries respirators from two manufacturers, so the probability of properly fitting most workers is increased.

2. Sight-impaired users must be fitted with prescription glass inserts for use inside full-facepiece respirators. Employees will be provided with safety prescription eyewear through the University Prescription Eyewear Program contact EHSEM for assistance.

   In lieu of glass inserts, contact lenses may be worn with full-facepiece respirators if they are rigid gas permeable or soft (hydrophilic) lenses, *except in atmospheres containing acylonitrile, methylene chloride, 1,2-dibromo-3-chloropropane, ethylene oxide, and methylene dianilene*. Hard, nonpermeable lenses shall not be worn with full-facepiece respirators.

3. Individuals with facial hair that interferes with the face-to-facepiece seal of tight fitting respirator facepieces will not be fit tested and these individuals shall not wear a respirator. Employees must be clean-shaven in order to receive a fit test. Employees with noticeable beard growth (more than 24 hours) will be asked to shave before receiving a fit test. Facial hair that does not interfere with the seal of the respirator may be allowed.

4. In order to assure a proper fit, two fit checks (employees will be instructed in how to conduct a fit check at the time of the fit test and during training) will be performed passed before the fit test will be conducted.

5. Fit Checking

a. Each time a respirator is donned, the user must perform positive and negative pressure fit checks. Respirator users will be properly trained in the performance of these checks and provided an understanding of their limitations.

b. Negative Pressure Check

i. Applicability - This test can only be carried out on face-pieces of air-purifying respirators equipped with tight-fitting respirator inlet covers and on atmosphere supplying respirators equipped with breathing tubes which can be squeezed or blocked at the inlet to prevent the passage of air.

ii. Procedure - Close off the inlet opening of the respirator's canister(s), cartridge (s), or filter(s) with the palm of the hand, or squeeze the breathing air tube or block its inlet so that it will not allow the passage of air. Inhale gently and hold for at least 10 seconds. If the face-piece collapses slightly, and no inward leakage of air into the face-piece is detected, it can be reasonably assumed that the respirator has been properly positioned and the exhalation valve and facepiece are not leaking.

c. Positive Pressure Check

i. Applicability - This test can only be carried out on respirators equipped with exhalation valves.

ii. Procedure - Close off the exhalation valve or the breathing tube with the palm of the hand. Exhale gently. If the respirator has been properly positioned, a slight positive pressure will build up inside the face-piece without detection of any outward air leak between the sealing surface of the face-piece and the face. It can be reasonably assumed that the respirator has been properly positioned and the inhalation valves are not leaking.

6. Fit Testing

a. Quantitative Fit Test: EHSEM uses quantitative fit testing in lieu of qualitative fit tests when applicable (i.e. when a full face respirator is required for proper protection).

i. Portacount Quantitative Test: This test is conducted by installing a probe within the respirator that allows the

Portacount test unit to measure air particle concentrations inside and outside of the mask. The respirator wearer is instructed to perform various exercises during the testing period and an overall fit factor is calculated to determine if the respirator provides adequate protection if worn properly.

b. Qualitative Fit Test: When it is necessary, qualitative fit testing can be an option for fit testing certain types of respirators and uses. Refer to Appendix B, "Qualitative Fit Testing Option Guidance," for guidance on acceptable qualitative fit testing circumstances. Below is a type of qualitative fit test protocols that may be used:

i. Banana oil/Saccharin Test: The employee is exposed to a fragrant odor test atmosphere while wearing a respirator equipped with organic vapor cartridges for banana oil and particulate filters for Saccharin. If the wearer detects odor or taste, an adjustment to the respirator is necessary; and

7. Respirator fit tests are documented and include the type of respirator, brand name and model, method of test, test date, and name of tester.

D. *MAINTENANCE, CARE, AND USE OF RESPIRATORY EQUIPMENT* - The employee and department are responsible for ensuring that respirators are properly used and cared for. This includes proper cleaning and disinfecting, storage, inspections, and proper cartridge/filter change-out and management.

1. Specific cleaning and disinfecting, storage, and inspection procedures can be found in the following training and respirator specific appendices:

a. **Appendix C** - Inspection Guidance for Air Purifying Respirators (APRs)

b. **Appendix D** - Information for Voluntary Users of Respirators

c. **Appendix E** - Respirator Training Information (For all Respirators except SCBAs, SARs, and PAPRs)

d. **Appendix F** - Specific Procedures For Use of Powered Air Purifying Respirators

e. **Appendix G** - Specific Procedures For Use of Supplied Air Respirators: Currently, there are no users of SAR units. Should the use of SARs be established in the future, this appendix must be used in conjunction with the SAR Manufacturer's operation manual.

f. **Appendix H** - Specific Procedures For Use of Self-Contained Breathing Apparatus – Currently there are no SCBA users.

2. Use of Respirators

a. The employees and their department shall ensure that respirators are used as set forth in this guideline.

b. Employees shall leave the respirator use area if they detect vapor or gas breakthrough, changes in breathing resistance or leakage of the facepiece.

c. Cartridge Change Out Schedule

i. Respirator cartridges shall be changed before the end of their service life. For cartridges with an End-of-Service-Life Indicator (ESLI) (e.g. mercury), replace the cartridges when indicated by color change. In the absence of an ESLI, the cartridges shall be change out a per regulations, manufacture's recommendations or as directed by the Program Administrator.

Cartridges designed for protection against particulates (e.g. HEPA filters) should be changed out once breathing resistance is noted, or every 6 months, whichever comes first. The Program Administrator representative assigned to a specific area may recommend a more specific and/or frequent change out schedule if necessary based on the following guidance:

a. Many variables exist that influence the service life of respirator cartridges. Some of these include characteristics and concentration of contaminant, amount and characteristics of filter media, breathing rate, temperature, and humidity.

b. Cartridge life expectancy for those chemicals and activities that have been identified as respirator

required tasks should be estimated whenever possible using calculators provided by respirator manufacturers that have been made available through the manufacturer's website.

c. Please refer to **Appendix I** for contaminant specific end-of-service-life information as well as an example printout from the SurvivAir ESLI calculator using xylene as an example.

i. An alternate method to determine when a respirator cartridge must be changed is the "Rule of Thumb". The Rule of Thumb states that if the chemical's boiling point is > 70°C and the concentration is less than 200 ppm and relative humidity is <75%, you can expect a service life of 8 hours at a normal work rate. At less than 20 ppm, 40 hours can be expected. This Rule of Thumb applies only to chemical cartridges that have been approved for the particular contaminant.

ii. Another method of establishing a change out schedule for respirator cartridges is using the **The Yoon-Nelson Mathematical Model**, which can also be found in **Appendix I**.

iii. Respirator cartridge change-out schedules should be documented and kept on file in the applicable department, if there is a deviation from the general 6 month change-out schedule. Change-out schedules should also be documented on the applicable "Information to the Physician" document by department.

The change-out schedules should be communicated to the applicable respirator users during training with proof of that training filed in the employee's fit test/medical surveillance file.

iv. Replacement cartridges are available through EHSEM upon request.

E. *ASSURANCE OF APPROPRIATE AIR QUALITY FOR AIR SUPPLYING RESPIRATORS* - Breathing air must meet the requirements for **Grade D** breathing air described in

ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-1989. Currently there are no SAR users.

1. These requirements include:

   a. Oxygen content of 19.5 – 23.5%

   b. Hydrocarbon (condensed) content of 5 milligrams per cubic meter of air or less

   c. Carbon monoxide content of 10 ppm or less

   d. Carbon dioxide content of 1,000 ppm or less

   e. Lack of noticeable odor

2. Breathing air from a cylinder must have moisture content in the cylinder that does not exceed a dew point of –50°F at one atmosphere pressure.

3. See the attachments entitled, "Specific Procedures For Use of Self-Contained Breathing Apparatus," (Appendix H) and "Specific Procedures For Use of Supplied Air Respirators" (Appendix G) for air quality information specific to those protective devices. (Currently, there are no SCBAs used on campus).

F. *TRAINING ON RESPIRATOR USE* – Training will be provided through EHSEM. Voluntary users of respirators (including filtering facepieces) will be supplied, at a minimum, with OSHA/MIOSHA information located in Appendix E. It is suggested that supervisors/PIs of employees wearing respirators also receive training in order to aid in ensuring employees are using respirators properly.

1. Training includes information on the following areas:

   a. Why respiratory protection is necessary and the consequences of misuse

   b. The limitations and capabilities of each respirator to be worn

   c. What to do in any emergency while wearing a respirator

   d. How to inspect, put on and remove, use, and check seals

e. Steps of proper maintenance and storage of the respirator

f. Potential adverse medical effects of respiratory use

2. See Appendix E for training information on respirators other than SCBA, SAR, or PAPR and a checklist used for training.

G. *PROGRAM EVALUATION* - The Program Administrator will ensure that periodic evaluations of the respirator program are done to ensure that the provisions of the written respirator program are being effectively implemented. The Program Administrator will also ensure that periodic respirator user consultations are conducted to determine its effectiveness and to identify any problems.

1. A formal evaluation shall be conducted at least annually and shall be done using the "Respirator Program Evaluation" form found in Appendix J**.**

2. Respirator user consultations via a survey will be done using the "Respirator User Survey Form" located in Appendix K. Factors that will be assessed include:

a. Respirator fit (including the ability to use the respirator without interfering with effective workplace performance)

b. Appropriate respirator selection for the hazards to which the employee is exposed

c. Proper respirator use under the workplace conditions the employee encounters

d. Proper respirator maintenance

H. *RECORDKEEPING*

1. Training

a. The employee's department will be responsible for maintaining training records. EHSEM will maintain backup training records.

2. Medical Evaluations

a. Confidential medical records will be retained by the administering clinic for the duration of the employee's employment plus 30 years. The PLHCP's written medical

opinions will be maintained by EHSEM for the duration of the employee's employment plus 30 years.

3. Fit Testing

    a. EHSEM will retain a record of the fit test of each employee **required** to wear a respirator for the duration of the employee's employment plus 30 years. The record will contain:

        i. The name of the person tested and UM-Dearborn ID #

        ii. The date of issue/test

        iii. The type of respirator fit test used

        iv. The specific make and model of the respirator issued

        v. The success or failure of the person to obtain a satisfactory fit during the test

        vi. The signature of the person administering the test

        vii. The signature of the tested individual indicating s/he was fit tested

4. Inspection

    a. Emergency use respirators will be inspected monthly, if used on campus, and the record kept for one year. These records will specify the inspection date, name of inspector, findings, remedial action, and a means to identify the respirator. Inspections will be kept in the area of respirator storage.

5. Program Evaluation

    a. EHSEM will maintain the records related to the periodic evaluation of the program effectiveness and implementation for at least 2 years.

TECHNICAL SUPPORT: All referenced guidelines, regulations, and other documents are available through EHSEM (3-4914).

Assistance in hazard evaluation, Medical Surveillance, and selection of respirators are also provided by EHSEM.

ATTACHMENTS:

Appendix A – Respiratory Equipment Selection and Guidance and the NIOSH Respirator Decision Logic Process

Appendix B – Qualitative Fit Testing Option Guidance

Appendix C – Inspection Guidance for Air Purifying Respirators (APRs)

Appendix D – Information for Voluntary Users of Respirators

Appendix E – Respirator Training Information (For all Respirators except SCBAs, SARs, and PAPRs)

Appendix F – Specific Procedures for Use of Powered Air Purifying Respirators

Appendix G - Specific Procedures for Use of Supplied Air Respirators

Appendix H – Specific Procedures for Use of Self-Contained Breathing Apparatus

Appendix I – Cartridge Change out Schedules / Cartridge Life Expectancies

Appendix J – Respirator Program Assessment Protocol

Appendix K – Respirator User Survey Form

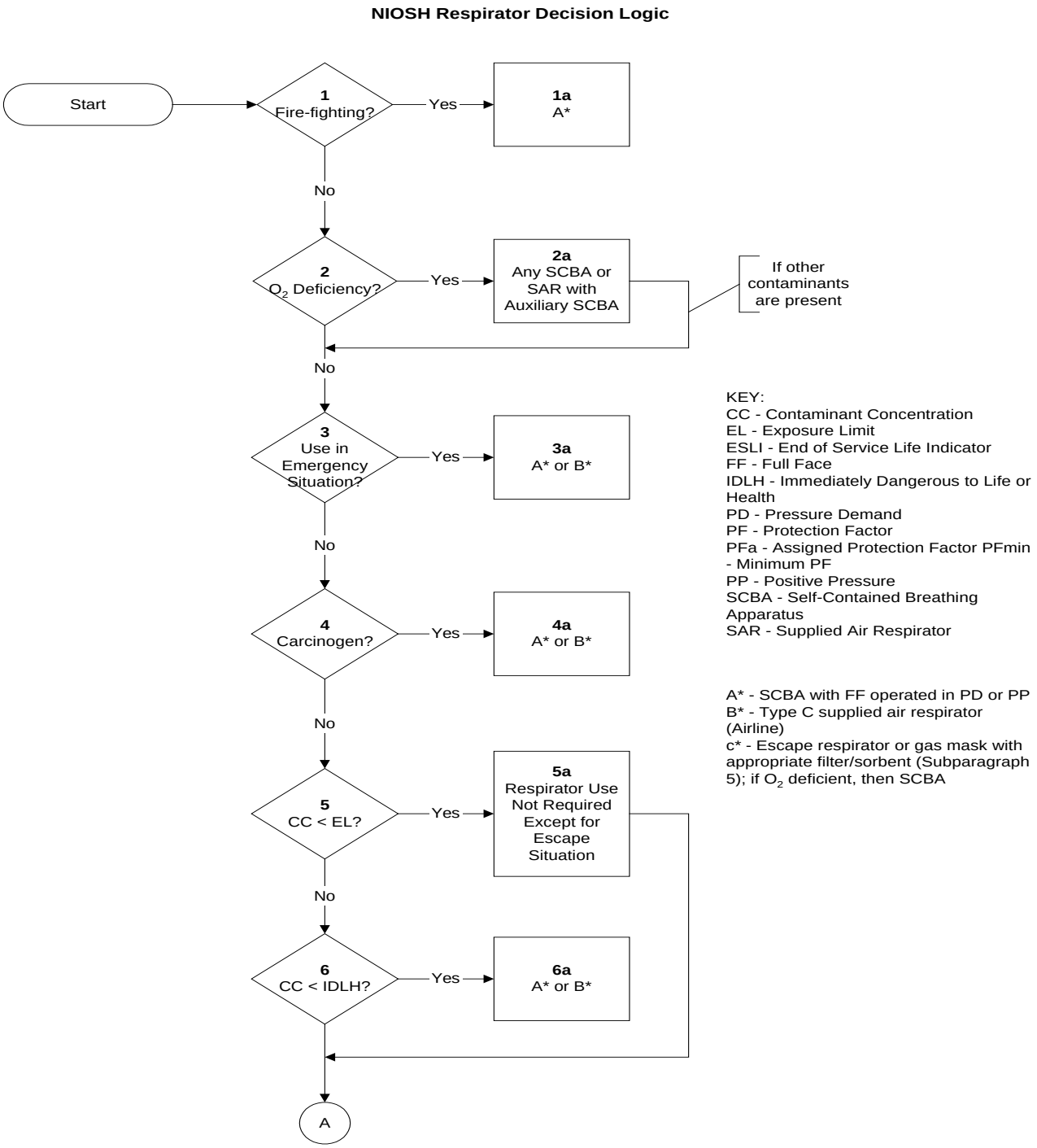
Appendix L – MIOSHA Respirator Assigned Protection Factor

Appendix A

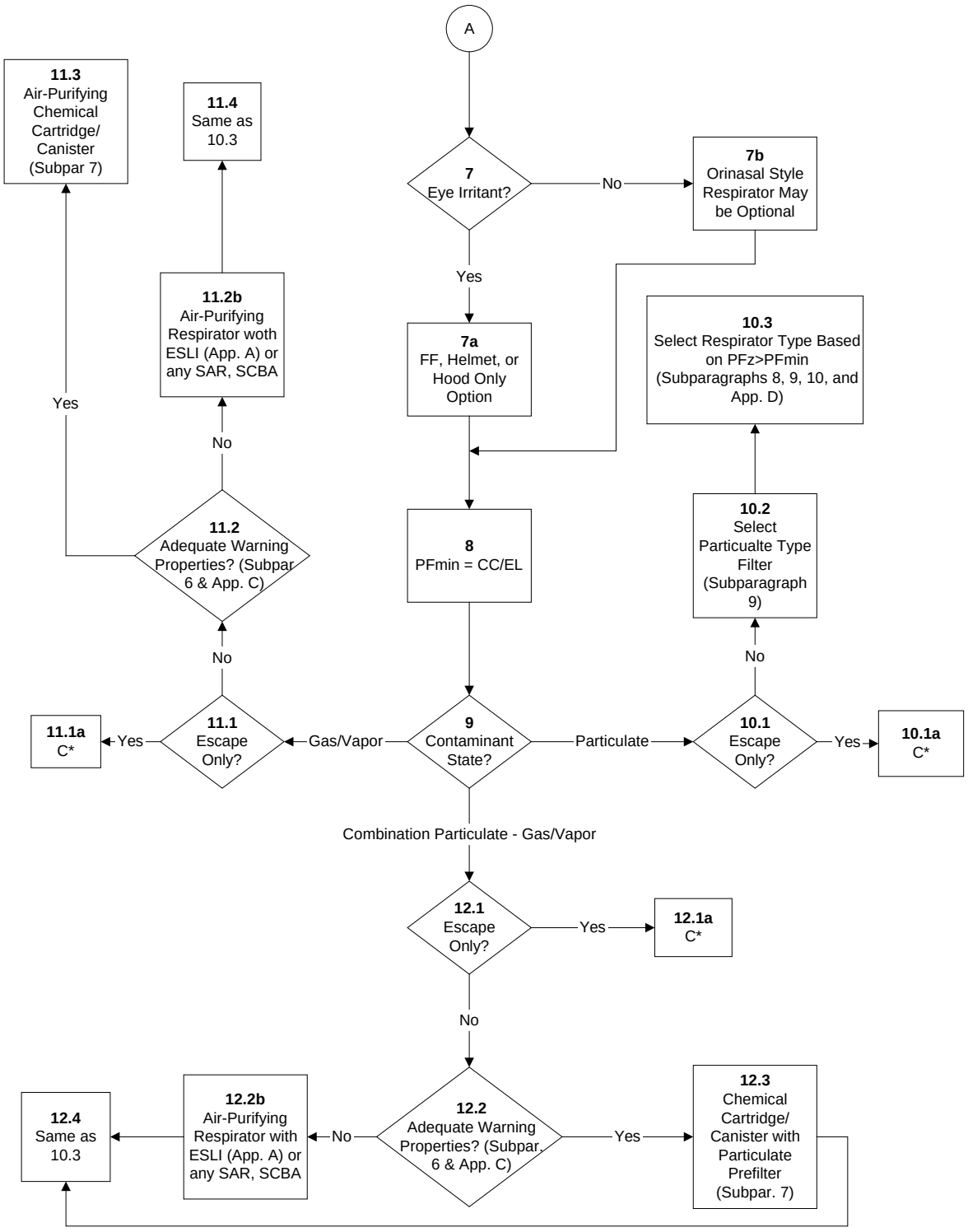
Respirator Equipment Selection Guidance and the NIOSH Respirator Decision Logic Process

As stated in this guideline, the Program Administrator is encouraged to use the NIOSH Respirator Decision Logic Process to aid in the proper selection of respiratory protective devices. Decision logic determinations for those exposures that data shows to exceed established exposure limits (e.g. EHSEM and ACGIH) should be documented and kept on file in the employee's department as well as at the EHSEM. Decision logic determinations should be communicated to those employees in the Respiratory Protection Program in the applicable area and made freely available to them for reference and training purposes. A flow chart of the NIOSH respirator decision logic can be found in **Figure 1** below as a reference.

Figure 1


NIOSH Respirator Decision Logic
Start
1
Fire-fighting?
Yes
1a
A*
No
2
O_2 Deficiency?
Yes
2a
Any SCBA or SAR with Auxiliary SCBA
If other contaminants are present
No
3
Use in Emergency Situation?
Yes
3a
A* or B*
No
4
Carcinogen?
Yes
4a
A* or B*
No
5
CC < EL?
Yes
5a
Respirator Use Not Required Except for Escape Situation
No
6
CC < IDLH?
Yes
6a
A* or B*
A
KEY:
CC - Contaminant Concentration
EL - Exposure Limit
ESLI - End of Service Life Indicator
FF - Full Face
IDLH - Immediately Dangerous to Life or Health
PD - Pressure Demand
PF - Protection Factor
PFa - Assigned Protection Factor PFmin - Minimum PF
PP - Positive Pressure
SCBA - Self-Contained Breathing Apparatus
SAR - Supplied Air Respirator
A* - SCBA with FF operated in PD or PP
B* - Type C supplied air respirator (Airline)
c* - Escape respirator or gas mask with appropriate filter/sorbent (Subparagraph 5); if O_2 deficient, then SCBA

NIOSH Respirator Decision Logic



The entire NIOSH Respirator Decision Logic guideline document is available online via the following link:

http://www.cdc.gov/niosh/87-108.html

In addition to the NIOSH Respirator Decision Logic and the information collected through the means described above, the Program Adminstrator will also use **Table 1** below as a guide in selection when the following hazards exist:

Table 1	
HAZARD	**MINIMUM REQUIRED RESPIRATOR, CARTRIDGES, AND FILTERS**
Oxygen Deficiency	Self-Contained Breathing Apparatus (SCBA)
Gas, Vapor, Particulate Contaminants	
Atmospheres Immediately Dangerous to Life or Health (IDLH)	Self-Contained Breathing Apparatus (SCBA)
Atmospheres not Immediately Dangerous to Life or Health (IDLH)	Half or Full-facepiece respirator with chemical cartridge, filter, or both. Available filters include particulate filters N95 (no oil present), R95 or P95 (oil present), or a combination of a particulate filter and some other kind of filtering/absorbing chemical cartridge. PAPR or supplied air systems can be an option.
Asbestos/Lead	- Half mask with HEPA or N/R/P100 filter; - Full facepiece with HEPA or N/R/P100 filter; and - PAPR with HEPA or P100 filter. - HEPA/particulate filters must be rated at n100 (no oil present), R100, or P100 (oil present)
Pepper spray or other crowd control agent	Gas Mask with gas canister
Formaldehyde	Half or Full-facepiece with acid gas cartridge or organic vapor/acid gas cartridge
Isocyanates	Self Contained Breathing Apparatus or Supplied Air Respirator
Solvents	Half or Full facepiece with organic vapor cartridges
Mercury vapor	Half or Full facepiece with mercury vapor cartridges
Silica	Half or Full facepiece with HEPA filter rated at N100 or P100
Welding Fumes	Welding respirator with HEPA filter N95 (no oil), R95 or P95 (oil present)

Table 1	
HAZARD	**MINIMUM REQUIRED RESPIRATOR, CARTRIDGES, AND FILTERS**
Infectious Agents (Pathogenic micro-organisms that can be transmitted via air and can cause disease in humans – includes TB, pigeon excrement, SARs, etc.)	- Half face with HEPA filter; - PAPR with HEPA filter; and - Disposable Dust Mask for protection against infectious diseases such as TB and SARs. Refer to UMHS infectious disease respirator plan(s). - HEPA/particulate filters must be rated at N100 or P100 - N95 Disposable Particulate Respirator is acceptable for TB protection
Nuisance Dusts (Does not include asbestos, radioactive material, or other toxic particulates	Disposable (paper) dust masks rated at N95

Note: The potential for eye irritation or eye injury from chemical splash or flying particulates may require the use of tight fitting full face NAPR, PAPR, and SAR or supplied air hoods or helmets. The use of half mask respirators in conjunction with chemical splash goggles is not advisable due to the difficulty in obtaining a good seal with the respirator, the goggles, or both. A tight fitting full face NAPR, PAPR, and SAR or supplied air hoods or helmets should be worn whenever both respiratory protection and eye protection are required.

If applicable, any operating procedures developed within an operating department shall clearly identify hazards that require or potentially require respiratory protection. The procedure shall state the minimum type of respiratory protection required for protection from the hazard. These procedures shall provide instructions on when and where protective equipment must be used and what type of equipment to use in situations that may arise.

Appendix B

Qualitative Fit Testing Option Guidance

The decision to perform a qualitative fit test (QLFT) may be based on the Acceptable Fit-Testing Methods table of this appendix (**Table 1**) below. This table was taken from the OSHA Directive Number CPL-2-0.120, "Inspection Procedures for the Respiratory Protection Standard." Although, only quantitative fit testing is being conducted.

Table 1

Acceptable Fit-Testing Methods

	QLFT	**QNFT**
Half-Face, Negative Pressure, APR (<100 fit factor)	Yes	Yes
Full-Face, Negative Pressure, APR (<100 fit factor) used in atmospheres up to 10 times the PEL	Yes	Yes
Full-Face, Negative Pressure, APR (>100 fit factor)	No	Yes
Positive Air Purifying Respirator	Yes	Yes
Supplied-Air Respirators (SAR), or SCBA used in Negative Pressure (Demand Mode) (>100 fit factor)	No	Yes
Supplied-Air Respirators (SAR), or SCBA used in Positive Pressure (Pressure Demand Mode)	Yes	Yes
SCBA – Structural Fire Fighting, Positive Pressure	Yes	Yes
SCBA/SAR – IDLH, Positive Pressure	Yes	Yes
Mouth bit Respirators	Fit-testing Not Required	
Loose-fitting Respirators (e.g., hoods, helmets)		

Appendix C

Inspection Guidance for Air Purifying Respirators (APRs)

Respirator inspections shall occur before each use and during cleaning. During the inspection of APRs, the following guidance is to be followed:

Examine the facepiece for:

Excessive dirt, cracks, tears, holes, or distortion;
Inflexibility (stretch and massage to restore flexibility);
Cracks or badly scratched lenses in full facepieces; and
Incorrectly mounted full-facepiece lens or broken or missing mounting clips.

Examine the head straps or head harness for:

Breaks;
Loss of elasticity;
Broken or malfunctioning buckles and attachments (full facepieces only); and
Excessively worn serrations on the head harness that might permit slippage.

Examine the exhalation valve for the following:

Foreign material, such as detergent, particles, or human hair under the valve seat;
Cracks, tears, or distortion in the valve material;
Improper insertion of the valve body in the facepiece;
Cracks, breaks, or chips in the valve body, particularly in the sealing surface; and
Missing or defective valve cover, improper installation of the valve body.

Examine the inhalation valve for the following:

Foreign material, such as detergent, particles, or human hair under the valve seat;
Cracks, tears, or distortion in the valve material;
Improper insertion of the valve body in the facepiece;
Cracks, breaks, or chips in the valve body, particularly in the sealing surface; and
Missing or defective valve cover, improper installation of the valve body.

Examine the filter(s) for:

Loading of filter(s) or replacement date on filter.

Examine cartridge(s) for:

Worn threads;
Cracks in housing; and
Worn or missing cartridge gasket.

Appendix D

INFORMATION FOR VOLUNTARY USERS OF RESPIRATORS

This appendix is provided for those individuals who are wearing respiratory protection, but are not required to do so under the OSHA/MIOSHA standards. Respirators are an effective method of protection against designated hazards when properly selected and worn. Respirators can be used, even when exposures are below the exposure limit, to provide an additional level of comfort and protection to workers. However, if a respirator is used improperly or not kept clean, the respirator itself can become a hazard to the worker.

The following precautions need to be taken to be sure that the respirator itself does not present a hazard:

1. Read and heed all instructions provided by the manufacturer on use, maintenance, cleaning, and care, and warnings regarding the respirators limitations.

2. Make sure that the respirator in use is adequately protecting against the contaminant of concern. All respirators and cartridges/filters issued through EHSEM are certified by NIOSH and are designed to protect against specific contaminants. Obtain all respiratory protection through EHSEM to ensure that the proper equipment is used.

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 against gases, vapors, or very small solid particles of fumes or smoke. If the contaminant of concern differs from that which you were originally evaluated for, call EHSEM to re-evaluate your protection.

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

Appendix E

Respirator Training Information (For all Respirators *except* PAPRs, SARs, and SCBAs)

Hazard Communication

Discuss with the employee the general health hazards associated with the contaminants for which they are requesting respiratory protection. Refer to **Table 1** of this appendix for hazard communication guidance. Discuss items such as potential for skin absorption and other items related to safety and health.

Proper Respirators for Specific Tasks

Discuss with the employee the specific use of respirator and cartridges for the work to be performed.

Chemical cartridges and filters do not have the same capabilities. For example, gas and vapor air purifying respirators provide no protection against particulate contaminants unless specified on the canister or chemical cartridge label. Likewise, particulate removing respirators protect against non-volatile particles and do not provide protection against gases and vapors. Neither of these types that are classified as air purifying respirators will provide protection where there is an insufficient oxygen level. A self-contained breathing apparatus (SCBA) is the appropriate respirator for emergencies in atmospheres containing less than 19.5% oxygen.

Assignment

Each respirator shall be permanently assigned to an individual. Other employees shall not use a respirator assigned to one employee. Other employees wishing to use respiratory protection must obtain their own respirator. Respiratory equipment shared by employees shall be properly cleaned after each use.

Employees with facial hair that comes between the sealing surface of the facepiece and the face, or that interferes with the valve function are not permitted to wear tight-fitting respirators.

Respirator Inspection

Prior to each usage, the employee should inspect the following:

1. Tightness of connections;
2. Condition of facepiece, straps, cartridges, and/or filters;
3. Condition of exhalation and inhalation valves. If the sides of the exhalation valve gap even slightly, a new valve shall be furnished;
4. Pliability and flexibility of rubber parts. Deteriorated respirators shall be replaced; and
5. Condition of lenses of full-face respirators. Damaged lenses shall be replaced or the respirator must be returned by Campus Safety & Security to the manufacturer.
6. EHSEM shall be the contact point for issue, repair, and return of all respirators.

Donning the Respirator and Checking its Fit and Operation

Instruct the employee on how to properly don and doff the respirator. This includes facepiece to face seal using the negative and positive pressure tests. Conditions that may possibly prevent a satisfactory seal include long side burns, a beard and/or mustache, temples on eyeglasses, absence of dentures, heavy

make-up or an unusual face structure. If the conditions cannot be corrected or eliminated, the worker shall not be assigned to any area requiring routine or emergency use of respiratory protection.

Cleaning the Respirator

It is the responsibility of the respirator wearer and his/her using department to ensure that all respiratory protective equipment is cleaned and sanitized. Cleaning and disinfecting shall occur according to the manufacturer's instruction at the following intervals:

i. Respirators issued for the exclusive use of an employee shall be cleaned and disinfected as often as necessary to be maintained in a sanitary condition;

ii. Respirators issued to more than one employee shall be cleaned and disinfected after each individual's use;

iii. Respirators maintained for emergency use shall be cleaned and disinfected after each use; and

iv. Respirators used in fit testing and training shall be cleaned and disinfected after each use.

In order to properly clean respiratory equipment, 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. Further guidance is as follows:

1. Wash components in warm (49º C [120º 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.

2. Rinse components thoroughly in clean, warm (49º C [120º F] maximum), preferably running water. Drain.

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

    a. Hypochlorite solution (50 ppm of chlorine) made by adding approximately one milliliter of laundry bleach to one liter of water at 49º C (120º F); or,

    b. 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% alcohol) to one liter of water at 49º C (120º F); or

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

        i. Rinse components thoroughly in clean, warm 49º C (120º F), 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.

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

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

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

7. EHSEM recommends the use of respirator refresher pads to disinfect the respirator after use.

Storage of Respirators

When not in use, the respirator and cartridges should be kept in a sealed plastic bag or plastic container, and stored in a clean, dry, moderate temperature, non-contaminated environment. It is especially important to keep gas and vapor cartridges in a sealed container so they do not absorb gases and vapors from the storage environment. Particulate filters, after used, should also be placed in a separate zip-lock style plastic bag to prevent possible contamination to the cleaned respirator and to protect them from dust and dirt that may reduce their service life. Care should be taken to prevent deformation of the respirator during storage. When respirators are taken into the workplace for use throughout the day, respirators must be stored inside a plastic bag in a manner that will prevent deformation of the facepiece and exhalation valve and in accordance with the manufacturer's instructions when not in use.

Respirators placed at workstations and work areas for emergency use shall be stored in compartments built for this purpose and must be quickly accessible at all times and clearly marked. Manufacturer's instructions shall be closely followed for proper storage of masks.

Respirator Limitations and Change-Out Schedules

A respirator and cartridges are selected for specific contaminants based on the tasks performed by the employee. A cartridge that filters one substance may not necessarily be used for another. Any new exposures need to be re-evaluated to ensure that the proper respirator protection is provided.

The service time of any cartridge or filter will depend on how often the respirator is worn and the levels of contamination in which it is used. Gas and vapor cartridges need to be changed at a minimum of every six (6) months or per the cartridge change-out schedule determined by the Program Administrator through the use of manufacturer cartridge life expectancy calculators or other means of life expectancy calculations. Particulate filters may also be changed out every six (6) months or sued until breathing resistance increases to an uncomfortable level.

General Limitations

As stated in the section on donning the respirator, beards, facial hair, mustaches, heavy make-up, dentures, and glasses can interfere with a face seal. Tight fitting respirators will not be issued to employees with facial hair that interferes with the seal. These employees shall not be assigned to any area requiring routine or emergency use of tight fitting respirators.

If the wearer of a respirator has a significant weight change (10 lbs or more), the employee shall be fit tested again.

Contact lenses may be worn with full-facepiece respirators if they are rigid gas permeable or soft (hydrophilic) lenses. Hard, nonpermeable lenses shall not be worn with full-facepiece respirators.

Campus Safety & Security recommends frequent breaks if a respirator is to be worn for any length of time.

Table 1

Hazard Communication Information

Respiratory Hazard	Examples	Health Effects
Oxygen Deficiency - Less than 19.5% oxygen by volume in respirable air)	May exist in confined spaces such as tanks, wells, and pits.	Effects range from slightly impaired coordination and breathing effects to nausea, vomiting, and unconsciousness, to death within minutes depending on percentage of O_2 in the air.
Asphyxiants Simple – Materials that displace O_2 in the air to create an O_2 deficiency. Chemical – Materials that act to render the body unable to utilize O_2	Simple – nitrogen, hydrogen, methane, helium, neon, argon Chemical – carbon monoxide, hydrogen, hydrogen sulfide, nitriles	See O_2 Deficiency
Carcinogens	Gas/Vapor – benzene, carbon tetrachloride, vinyl chloride Particulate – radioactive particulate, asbestos, chromates	Development of cancer after a period of time
Irritants	Gas/Vapor – ammonia, hydrogen chloride, sulfur dioxide, hydrogen sulfide, chlorine, ozone Particulate – fiberglass, acidic mists, alkali mists	May cause irritation and inflammation to various parts of the respiratory system. Pulmonary edema may also result. Chronic bronchitis may be seen with long term exposure. Eye and skin irritation may also be a concern
Systemic Poisons	Gas/Vapor – mercury, lead, hydrogen sulfide, organic solvents, pesticides, ethylene oxide, ether, carbon tetrachloride, chloroform, benzene, carbon disulfide, Particulate – lead, cadmium, pesticides	Acute effects may include irritation to eyes, nose, and throat, headache, nausea, vomiting, dizziness, drowsiness, incoordination, and unconsciousness. Long term exposure may involve damage to organs and systems such as nervous system, kidneys, liver, blood, bone or respiratory system. May also have reproductive effects. Skin absorption may also be an important route of exposure.
Allergy-producing	Animal furs, pollens, molds, formaldehyde, pesticides, ethylenediamine	Reactions may include itching, sneezing, and asthma. Other hypersensitive reactions may also occur. Skin contact may also be a concern.

Respiratory Hazard	Examples	Health Effects
Pulmonary-fibrosis producing	Silica, asbestos	Fibrotic disease in lungs
Febrile-producing	Fumes of zinc, iron, and copper (usually associated with welding)	Flu-like disorder with fever and chills that typically last 24 to 48 hours.
Nuisance particulate	Construction dust, plaster dust, ceramics, sawdust	May cause discomfort and irritation but usually not associated with causing any adverse health problems.
Infectious Agents (pathogenic microorganisms that are transmitted through air and can cause disease in humans)	TB, pigeon excrement	May cause infection and disease specific to the pathogen.

Respirator Training Information Checklist

USE	Why the respirator is necessary; Include general information on hazards of substance.	☐
	For initial fit testing, the user should be given opportunity to select the respirator and size that is most comfortable. Respirator should be worn at least five minutes to asses comfort.	☐
	Inspection: Should be performed before each use- Check valves, headstraps, facepiece, etc. for any defects. All problems must be replaced/repaired before use.	☐
	Instruct user how to don, doff, and use respirator. Demonstrate donning, positioning on the face, setting strap tension, and doffing. Strap tension must be readjusted with each use.	☐
	Fit should be assessed by using the following criteria: placement of the chin; adequate strap tension (not overly tightened); fit across nose bridge; proper size to span from nose to chin; tendency to slip.	☐
	Seal check: Positive and negative pressure checks must be done each time the respirator is used.	☐
	Conditions that may prevent a satisfactory seal include long sideburns, a beard (more than 24 hours growth), and/or mustache, temples on eyeglasses, absence of dentures, heavy makeup, or unusual face structure. Fit Test will not be conducted if wearer has any facial hair that infers with the sealing areas of the respirator.	☐
	How improper fit, usage, or maintenance can compromise the protection provided by the respirator.	☐
	Limitations and capabilities of respirator – only will protect for contaminant indicated in use, i.e., Organic vapor cartridge on a ½ face will not protect against oxygen deficient atmosphere.	☐
	Medical signs and symptoms: Respirator use may cause increased physiological stress on the heart and lungs. This is why all respiratory users receive a medical exam prior to receiving a respirator. If you experience symptoms such as dizziness, difficulty breathing or irritation, leave the area immediately, remove respirator, and inform your supervisor/PI. In addition, you may need an addition medical examination if your personal health status has changed in any way that may affect your respirator use.	☐
CARTRIDGES	Cartridges are designed for specific contaminants. The cartridges issued are selected according to the particular substance that will be used. Consult EHSEM if substance used changes to ensure that the proper cartridge is used.	☐
	Gas/Vapor cartridges should be changed out every 6 months (at a minimum), or anytime odor has been detected. Alternatively, change out at a frequency that the program administrator deems fit. For cartridges with and End-of Service-Life Indicator (ESLI), e.g. mercury, replace the cartridges when indicated by the color change. HEPA filters should be changed out once breathing resistance increases or if the filers become wet.	☐
CLEANING	Respirators should be washed regularly with warm soapy water. Remove cartridges prior to washing. In between washings, the respirator may be wiped with respirator wipe pads after each use.	☐
STORAGE	Keep respirator and cartridges in a clean, dry plastic bag when not in use.	☐
	Ensure that the respirator is dry before storing. Respirators should be air-dried rather than mechanically dried after washing.	☐
	Do not store respirator in a contaminated area.	☐
	Do not store respirator where it can be crushed.	☐
	Do not expose the respirator to temperature extremes.	☐
INFORMATION	If “Required” user, inform that they will need to have annual fit tests and training.	☐
	If “Voluntary” user, supply with Appendix D	☐

Appendix F

Specific Procedures for the Use of Powered Air Purifying Respirators

This attachment is meant to supplement the Respiratory Protection Program and is specific to the use of powered air purifying respirators (PAPRs). This appendix should be used in conjunction with the PAPR manufacturer's operation manual. **Currently, there are no PAPR users on campus.**

Selection and Use

PAPRs will be used in situations where adequate protection with an air-purifying respirator is appropriate. Units will be equipped with either a tight-fitting full facepiece or a loose-fitting hood or helmet. The loose-fitting headgear may be worn in areas where individuals are not required to shave, but have a need for respiratory protection given that this is an appropriate level of protection as determined by EHSEM.

PAPRs will not be utilized for situations where the hazardous substance lacks adequate warning properties (odor, taste, smell), or the air concentration exceeds that which could adequately be protected from the use of a negative pressure air-purifying respirator. It will also not be used for emergency response situations in which an oxygen deficiency or IDLH atmosphere may be encountered.

All PAPR units must be NIOSH approved.

Authorized Users of PAPRs

All potential users of PAPRs must contact the Program Administrator at 3-4914 and comply with all provisions of the Respiratory Protection Program and this attachment. Authorized users must meet the following specific criteria in addition to the criteria set forth in the Respiratory Protection Program:

1. The PLHCP must determine that the user is physically able to wear a PAPR and perform work.

2. The individual must be fit tested through EHSEM with a facepiece of the same make, model, and size as the PAPR unit that will be assigned to the user. A fit test may be conducted annually if the usage is determined to be mandatory. Fit testing will not be required if a loose-fitting facepiece is used.

3. The user must attend respirator training and will receive refresher training through EHSEM annually.

4. Sight-impaired users can be fitted with prescription glass inserts for use inside a tight-fitting full-facepiece. Employees will be provided with safety prescription eyewear through the University Prescription Eyewear Program. Rigid gas permeable or soft (hydrophilic) contact lenses can be worn with full-facepiece respirators in lieu of glass inserts.

Current authorized users of PAPRs include the following:

1. Tight-Fitting PAPR:

    a. None

2. Loose-Fitting PAPR:

    a. Facilities Management Automobile Mechanic

Location and Storage

Respirators should be stored to protect them from weathering, contamination, and deterioration. The respirator should be located so that unauthorized users cannot "borrow" to enter the area.

Batteries should be charged in a location that is maintained at room temperature. Temperature extremes may shorten the capacity of the battery unit. Batteries should not be recharged in an enclosed area that lacks ventilation and charging units should not be stored on top of each other.

Standard Operating Procedures

Before entering an area where PAPRs are used, the following procedures must be followed:

1. Conduct an inspection of the facepiece unit to assure proper working order of all components. Check the lens for scratches, nicks, and gouges. Check the skirt, head strap, and buckles for any signs of damage or wear. Hoods or head covers should be checked for any holes/tears in the material;

2. Appropriate cartridges should be attached to the unit. Refer to the Respiratory Protection Program for information pertaining to cartridge selection and change out schedules;

3. Batteries should be checked to ensure that they are fully charged;

4. A flow check should be conducted according to the manufacturer's guidelines. Acceptable airflow is four (4) cubic feet per minute (cfm) for tight-fitting facepieces and 6 cfm for loose-fitting facepieces; and

5. When all of the above provisions are in place, the authorized employees may don the PAPRs in accordance with the manufacturer's specifications and enter the work area. It is recommended to wear the facepiece under any protective outerwear that covers the head.

Cleaning

Individually assigned respirators should be cleaned and maintained by the user as needed. Shared PAPRs shall be cleaned and disinfected after each use in accordance with the manufacturer's operation manual. PAPR components (motor/blower, battery, breathing tube) and hoods should not be immersed in liquids and instead should be wiped down with a damp towel or sponge.

Battery Maintenance

There are two options for battery pack maintenance:

1. Assigning each user a battery pack and charger to individually maintain a charged battery; or

2. Establishing a central battery management system where an individual will be responsible for charging and distributing the batteries to the users.

    a. The central management system is usually effective in situations with large numbers of users.

When maintaining batteries, only use the charger supplied with the battery pack. The user should connect the battery to a charger at the end of each work shift and disconnect it at the beginning of the next shift. If a central charging area is used, the batteries should be clearly marked to avoid accidental usage of uncharged batteries. Reserve batteries should be available.

An expected run-time test should be conducted to determine the number of hours the battery will be able to power the respirator at the acceptable airflow rate. The battery should be fully charged prior to start of the test and the PAPR must be equipped with all cartridges, breathing tube, and head piece. The PAPR should maintain the required airflow for eight (8) hours or the unit needs troubleshooting or repair. Follow manufacturer's instruction for conducting this test and for troubleshooting.

Batteries should be recharged when the recharge indicator light is on (if equipped) or when reduced airflow is detected. Note that an overloaded filter may also cause reduced airflow. Batteries should not be charged continuously for more than one week. This will cause deterioration of the battery pack due to heat generation. A typical service life for a nickel-cadmium battery pack is 500 charge/discharge cycles.

For infrequent PAPR usage, it is recommended that battery packs be initially charged fully, and then follow the manufacturer's suggested schedule for maintenance of a full charge. This will prevent storage loses that may occur if periodic charging does not take place. Batteries subjected to long periods of storage (longer than 1 year) may lose their capacity to hold a full charge. Executing several charge and discharge cycles may restore battery capacity.

Maintenance

When any aspect of the PAPR system fails to work properly, the system must be immediately red tagged. An authorized service facility with factory-trained technicians should be contacted for repair. Contact your vendor or EHSEM for contact information.

Battery Repair and Disposal

Some batteries can be repaired if problems arise. Consult the manufacturer or EHSEM for more information. Battery packs that have reached the end of their service life due to damage or age should be placed in a campus battery recycling collection box.

New Equipment Purchase

The Program Administrator should authorize purchases of PAPR systems.

Appendix G

Specific Procedures for Use of Supplied Air Respirators

This attachment is meant to supplement the Respiratory Protection Program and is specific to the use of Supplied Air Respirators (SARs). **Currently, there are no users of SAR units**. Should the use of SARs be established in the future, this appendix must be used in conjunction with the SAR Manufacturer's operation manual.

Selection and Use

SARs will be used during maintenance activities where the hazardous substance, in certain atmospheres, lacks an adequate warning property (odor, taste, smell), or air concentrations may exceed that which could be adequately protected from use of negative pressure air purifying respirators.

SAR units will not be utilized for emergency response situations where oxygen deficiency or IDLH atmospheres may be encountered.

All SAR units must be NIOSH approved, positive pressure, continuous flow, and have a full facepiece.

Authorized Users of SARs

All potential users of SARs must register with the Program Administrator by calling 3-4914 and complying with all provisions of the Respiratory Protection Program and this attachment. Authorized users must meet the following specific criteria in addition to the criteria set forth in the Respiratory Protection Program:

1. A PLHCP must determine that the user is physically able to wear an SAR and perform work;

2. The individual must be fit tested through EHSEM with a full facepiece of the same make, model, and size as the SAR unit that will be assigned to the user. A fit test must be conducted annually. Fit tests will not be required if a loose-fitting facepiece is used;

3. The user must attend initial respiratory and refresher training annually through EHSEM. The user should also receive training from the manufacturer/supplier or the department in the use and wearing of SARs; and

4. Sight-impaired users can be fitted with prescription glass inserts for use inside the full-facepiece. Employees will be provided with safety prescription eyewear through the University Prescription Eyewear Program. Rigid gas permeable or soft (hydrophilic) contact lens can be worn with full-facepiece respirators in lieu of glass inserts.

Location and Storage

Respirator facepieces must be stored outside of the work area where they will be worn. Respirators should be stored to protect them from weathering, contamination, and deterioration. Each individual should be assigned their own facepiece and it should be located so that unauthorized users cannot "borrow" to enter the area.

Standard Operating Procedures

Before entering an area where SARs are used, the following procedures must be followed:

1. Conduct an inspection of the facepiece unit to assure proper working order of all components. Check the lens for scratches, nicks, and gouges. Check the skirt, head strap, and buckles for any signs of damage or wear;

2. Check the service life of the cylinder and estimate the amount of time needed to complete tasks. If necessary, have additional cylinders on hand so as to facilitate change out of cylinders to complete tasks. For compressors, check the pressure gauge to make sure that it is at an acceptable pressure for use;

3. Individuals entering the area and donning SARs should make notification to others outside of the work area before entry. The backup personnel that is notified is responsible for ensuring that the employees are working safely inside the work area and should be present until they exit the work area. The backup individual should notify Public Safety at 3-5333 in the event of an emergency and should never attempt to enter the work area themselves;

    a. Assure there is a means for continuous communication between both authorized employees who will be entering the work area and the outside personnel. Communication can be accomplished by radio, visual signals, a signal line, etc.; and

4. When all of the above provisions are in place, the authorized employees may don the SARs in accordance with the manufacturer's specifications and enter the work area.

Cleaning

SARS shall be cleaned and disinfected after each use in accordance with the manufacturer's operation manual.

Inspection

All SAR systems should be inspected at least monthly and checked for proper function before and after each use. The inspection should be documented and maintained to serve as a written certification of the monthly inspection. Facepieces should be inspected by the user prior to use and is not necessary to be documented.

1. The following inspection guidance can be referenced during inspection of SAR units:

    a. Examine the facepiece for:

        i. Excessive dirt, cracks, tears, holes, or distortion;

        ii. Inflexibility (stretch and massage to restore flexibility);

        iii. Cracks or badly scratched lenses in full facepieces; and

        iv. Incorrectly mounted full facepiece lens or broken or missing mounting clips

b. Examine the head straps or head harness for:

    i. Breaks; Loss of elasticity;

    ii. Broken or malfunctioning buckles and attachments (full facepieces only); and

    iii. Excessively worn serrations on the head harness that might permit slippage.

c. After removing its cover, examine the exhalation valve for the following:

    i. Foreign material, such as detergent, particles, or human hair under the valve seat;

    ii. Cracks, tears, or distortion in the valve material;

    iii. Improper insertion of the valve body in the facepiece;

    iv. Cracks, breaks, or chips in the valve body, particularly in the sealing surface; and

    v. Missing or defective valve cover, improper installation of the valve body.

d. If the device has a corrugated breathing tube, examine it for:

    i. Broken or missing end connectors;

    ii. Missing or loose hose clamps; and

    iii. Deterioration (determined by stretching the tube and looking for cracks).

e. When the device is a hood, helmet, blouse, or full suit, the following should be done:

    i. Examine for rips, tears, seam integrity, and general condition of inlet air and out air connections;

    ii. Examine protective headgear for general conditions with emphasis on the suspension inside the headgear;

    iii. Examine the protective face shield for cracks, breaks, impaired vision due to rebounding abrasive particles, or chemical action on the lenses; and

    iv. Make sure that the protective screen is intact and secured correctly over the facepiece of abrasive blasting hoods and blouses.

f. Examine all atmosphere-supplied respirators for:

    i. Integrity of air supply hoses and lines;

    ii. Adequate and correct fittings for hose and lines;

iii. Correct operation and condition of all regulator valves on air supply systems, belt-mounted regulator valves, exhalation valves of discharge air openings, or other air-flow regulators; and

iv. Correct particulate filters or organic vapor filter in the air supply system.

Maintenance

When any aspect of the SAR system fails to work properly, the system must be immediately red tagged. An authorized service facility with factory-trained technicians should be contacted for repair. Suggested authorized service facilities are:

Argus Supply, 46410 Continental Drive, Chesterfield, MI 48047

Phone: 1-800-873-0456

Spears Fire and Safety Services, Inc., 287 Jackson Plaza, Ann Arbor, MI 48103

Phone: 734-663-4133

All air cylinders used must supply at a minimum Grade D breathing are.

Breathing air compressor units should supply Grade D breathing air at a minimum. The units should be constructed to prevent entry of contaminated air into the air supply system as well as be equipped with in-line air purifying sorbent bends and filters to further ensure breathing are quality. Sorbent bends and filters should be maintained and replaced periodically per the manufacturer's instructions. A tag should be maintained at the compressor that details the change date and signature of authorized person.

If compressors are not oil-lubricated, carbon monoxide levels must not exceed 10 ppm in breathing air. If compressors are oil-lubricated, they must have a high-temperature alarm or CO alarm, or both. If the unit is only equipped with a high-temperature alarm, CO needs to be periodically monitored to ensure that levels do not exceed 100 ppm in breathing air.

New Equipment Purchases

The Program Administrator should authorize purchase and installation of new SAR systems. All breathing air couplings must be incompatible with outlets for non-respirable worksite air or other gas systems.

Appendix H

Specific Procedures for Use of Self-Contained Breathing Apparatus

This appendix is meant to supplement the Respiratory Protection Program and is specific to the use of Self-Contained Breathing apparatus (SCBA) for emergency response. This attachment is meant to supplement the Respiratory Protection Program and is specific to the use of Self-Contained Breathing Apparatus (SCBA). **Currently, there are no SBCA users**. Should the use of SCBAs be established in the future, this appendix must be used in conjunction with the SCBA Manufacturer's operation manual.

It should be noted that SCBAs will provide the highest level of respiratory protection and it is important to use the appropriate protective clothing to complete the ensemble. In particular, full body protection is needed in emergency situations where gas or vapor is present that can be absorbed through the skin or cause deterioration of the SCBA components.

Selection and Use

SCBAs will be used during certain maintenance activities or operations where other respirator protection is not adequate based on the toxicity and warning properties of the hazardous materials (such as Isocyanates), or when responding to emergencies where:

- The atmosphere presents an oxygen deficiency (less that 19.5% oxygen);
- There is a concentration of a hazardous chemical that is immediately dangerous to life or health (IDLH);
- Where the hazardous substance, in certain atmospheres, lacks an adequate warning property (odor, taste, smell), or the identity or quantity of the substance is unknown and in the professional judgment of the emergency responder, air concentrations may exceed that which could be adequately protected from use of negative pressure respirators; and
- It is deemed necessary by the emergency response personnel.

Normally the determination to use SCBA in an emergency shall be made by key facility personnel who have attended Emergency Response Training.

When such an emergency arises, authorized University personnel to affect rescue or mitigate the release of a hazardous material will wear SCBAs. All SCBA units used for emergency purposes will be NIOSH approved, open circuit/pressure demand, with a full-facepiece.

Authorized Users of SCBA

All potential users of SCBA must register with the Program Administrator by calling 3-4914 and complying with all provisions of the Respiratory Protection Program and this attachment. Authorized users must meet the following specific criteria in addition to the criteria set forth in the Respiratory Protection Program:

1. Medical Surveillance

a. The annual medical surveillance must determine that the user is physically able to wear an SCBA and perform the work;

b. The individual must be fit tested through Campus Safety & Security with a full-facepiece of the same make, model, and size as the SCBA unit which may potentially be used;

c. The user must have attended the Emergency Response Training course and receive semi-annual refresher training through Campus Safety & Security or the manufacturer/supplier in the use and wearing of SCBA; and

d. Sight-impaired users can be fitted with prescription glass inserts for the use inside the full-facepiece. Employees will be provided with safety prescription eyewear through the University Prescription Eyewear Program. Rigid gas permeable or soft (hydrophilic) contact lenses can be worn with full-facepiece respirators in lieu of glass inserts.

Current Users

There are currently no SCBA users.

Location and Storage

The location and storage of SCBA units must be thought out carefully in order to afford adequate protection of staff and emergency responders and at the same time provide effective and timely response to the emergency at hand. Each university building that has a potential for using SCBAs during an emergency need not be equipped with SCBAs. Instead, SCBA units may be placed in a strategic location, so that responders can access them quickly and safely and respond to emergencies in several different buildings in the area. Under no circumstances will SCBAs be placed in or just outside of the area where an oxygen deficient or IDLH atmosphere is possible. The area where responders pick up and/or don this equipment must be free from potential hazards. EHSEM can assist departments in determining a suitable storage location.

When a suitable location has been determined, SCBAs should be stored in a compartment built for this purpose. The compartment must be secured or locked to prevent unauthorized use of SCBAs. Planning must be such that all authorized users have the ability to access the units quickly, 24 hours a day. They should also be stored in a manner to protect them from weathering, contamination, and deterioration. The storage area should be clearly marked as containing emergency respirators.

Standard Operating Procedures

Employees who have received Emergency Response Training will assess the emergency. If key facility staff determines that SCBAs are needed due to the potential presence of an atmosphere that is IDLH, the following procedures will be followed:

1. Contact Public Safety at 911 and inform them of the exact nature of the emergency and need for SCBA use. Also, report the number of SCBA units, breathing air cylinders on hand, and the number of authorized users on hand;

2. EHSEM will respond to the emergency and provide technical assistance. The procedures described below will be followed by University departments in using SCBAs during emergencies:

   a. Conduct an inspection of the SCBA units to assure proper working order of all components. Check the service life of the cylinder and estimate the amount of time needed to complete the emergency tasks. If necessary, have additional cylinders on hand so as to facilitate change out of cylinders to complete the emergency tasks. Consider the time to and from the emergency work area and decontamination (if necessary) when estimating the time to complete the task;

   b. No attempt will be made to don a SCBA and respond to the emergency until there are four (4) SCBA units and four (4) authorized users present. A buddy system will be used, whereby two (2) authorized employees don SCBA and enter the emergency work area. As a backup, the other two (2) authorized employees will stay in a safe area with SCBA donned (except for mask and use of breathing air) ready to enter the emergency work area if necessary. There must be two (2) backup authorized employees with SCBA at all times, therefore, two (2) additional authorized employees and SCBAs must be on the scene before backup personnel take any action to enter the emergency work area. EHSEM emergency responders will provide backup in emergency situations;

   c. Assure there is a means for continuous communication between both authorized employees who will be entering the emergency work area and the backup personnel. Communications can be accomplished by radio, visual signs, a signal line, etc.;

   d. When appropriate, authorized employees entering the hazardous area with SCBA should be equipped with retrieval equipment or lifeline to aid in rescue, should it become necessary. If this is not feasible, there must be some equivalent provisions for rescue; and

   e. When all of the above provisions are in place, the authorized employees (including the backup personnel) may don the SCBAs in accordance with the manufacturer's specifications and enter the emergency work area.

   f. NOTE: There may be some situations where responders decide to use SCBAs when there is not an IDLH atmosphere present. In these cases, a SCBA may be used in the same manner as a negative pressure respirator, without outside assistance or a buddy system.

<u>Cleaning</u>

SCBAs shall be cleaned and disinfected after each use in accordance with the manufacturer's operation manual.

<u>Inspections</u>

All SCBAs shall be inspected at least monthly and checked for proper function before and after each use using the inspection sheet and inspection table developed by the Program Administrator

(see attached). The inspection sheet will serve as a written certification of the monthly inspection and shall be maintained for each SCBA.

The inspection sheet must be kept in an area where it is available for inspection by authorized users, EHSEM, and state/federal inspectors. It is recommended that the sheet be kept in a three-ring binder located in an area separate from the SCBAs. A tagging system should be used for the SCBA itself to indicate the units have been inspected and passed. Inspection tags should indicate the SCBA number, inspection date, and inspector's initials. Tags are available from EHSEM at 3-4914.

The following is general guidance that can be referenced during the inspection of SCBAs using the SCBA Inspection Table (**Table 1**) and the SCBA Logs attached:

1. Visually inspect the complete respirator for worn or aging rubber parts, worn or frayed harness webbing or damaged components;

2. Check the latest cylinder hydrostatic test date to ensure it is current. All cylinders must be visually inspected monthly and hydrostatically tested by a licensed cylinder retester in accordance with the appropriate US Department of Transportation (DOT) specification or the applicable DOT exemption;

    a. University cylinders are made of composite construction and must be hydrostatically tested every three (3) years. If during the inspection it is noted that hydrostatic testing is necessary again, note it on the inspection sheet and report it to EHSEM.

3. Visually inspect cylinder and valve assembly for physical damage such as dents or gouges in metal. Cylinders that show physical damage or exposure to high heat or flame, such as paint turned brown or black, decals charred or missing, pressure gauge lens melted or elastomeric bumper distorted, and cylinders that show evidence of exposure to chemicals such as discoloration, cracks in the cylinder, or bulging of the cylinder wall shall be removed from service and emptied of compresses air;

4. Check cylinder pressure gauge for "FULL" indication. If cylinder pressure is less than "FULL," replace with a fully charged cylinder;

5. Check to ensure reducer hose coupling is hand tightened to the cylinder valve outlet;

6. Check that the breathing regulator purge valve is closed;

7. Don the facepiece or hold the facepiece to the face to effect a good seal. Inhale sharply to automatically start the flow of air. Breathe normally from the facepiece to ensure proper operation;

8. Clean and sanitize mask when done; and

9. File the inspection form in a binder with the SCBAs and retain them for one year after inspection, then destroy.

Table 1

COMPONENT	LOOK FOR
FACEPIECE LENS	1. Nicks, scratches, or abrasions that could impair vision; 2. Deep gouges or cracks that could reduce impact resistance; and 3. Anti-fog coating in need of replacement.
FACEPIECE RIMS	1. Deformed, cracked or broken rims; and 2. Loose rim screws (do not over tighten).
FACEPIECE SKIRT	1. Cuts, gouges, or punctures; 2. Tears or nicks in the sealing area; and 3. Deterioration from age, heat or contamination.
FACEPIECE HEAD STRAP	1. Abrasions or nicks; and 2. Deterioration from age, heat or contamination.
FACEPIECE BUCKLES	1. Crushed, bent, or corroded; and 2. Damaged or loose rivets.
FACEPIECE INLET NOZZLE	1. Loose nozzle cover screws; 2. Heat damage to the nozzle body and cover; 3. AIR KLIK not seated and locking pawl not engaged; 4. Dirt and debris in the exhalation module; 5. Sticking exhalation valve; and 6. Damaged exhalation valve set.
SECOND STAGE REGULATOR & HOSE	1. Cracks or heat damage to housing or cover; 2. Faulty operation of bypass valve, first breath-on, AIR KLIK or override buttons; 3. Dirt and debris in the outlet port; screen and grill cracked; 4. Hose or fittings corroded, cracked or leaking; and 5. Sticking release and shutoff buttons.
GAUGE/ALARM ASSEMBLY	1. Gauge lens scratched; pointer deformed or stuck; 2. Hose or fittings corroded, cracked or leaking; 3. Debris in whistle outlet; and 4. Loose back plate screws.
FIRST STAGE REGULATOR & HOSE	1. Hose and fittings corroded, cracked or leaking; 2. Loose retaining rings on hose connectors. Loose inlet nipple; 3. Abrasion of hose; 4. Damaged female threads on C.G.A. hand wheel; 5. Damaged O-ring or groove on C.G.A. nipple; 6. Loose inlet nipple; 7. Missing O-ring; 8. Dents or heat damage to housing; and 9. Loose pressure port screws.
HARNESS FRAME	1. Cylinder band and latch not working properly; 2. Cylinder not secured in frame and band; 3. Bent or broken frame; 4. Webbing color change; excessive wear or fraying; cuts, nicks, nicks or broken stitching; 5. Buckles damaged or corroded; and 6. Loose Hardware.
AIR CYLINDER & VALVE	1. Dents, gouges, blisters, or cuts; 2. External damage to cylinder valve; 3. Smooth operation of valve hand wheel and ratchet collar; 4. Loose screws securing rubber guard on cylinder valve; 5. Condition of threads on valve outlet; 6. Cylinder pressure gauge lens scratched; pointer deformed or stuck; 7. Gauge reading incorrectly; and 8. Hydrostatic test date within 3 years.

Maintenance and Repair

For SCBA units that fail inspection, the unit must be immediately taken out of service and red tagged. The deficiency must be noted in the inspection log and an authorized service facility with factory-trained technicians should be contacted for repair. Suggested authorized service facilities are the manufacturer or:

Argus Supply

Phone: 1-800-873-0456

Spears Fire and Safety Services, Inc., 287 Jackson Plaza, Ann Arbor, MI 48103

Phone: 734-663-4133

Refilling Air Cylinders

Refilling of high-pressure cylinders (4500 psi) is arranged through EHSEM (3-4914).

New Equipment Purchases

Purchase of new SCBA units should be coordinated with EHSEM.

EHSEM Equipment Specifications

SurvivAir with classic facepiece;

45 minute NFPA High Pressure 4500 psi, fully wrapped fiberglass side release buckle; and Carrying case and accessory kit, five strap head harness and skirt.

SCBA TANK INSPECTION LOG

YEAR: _____ SCBA #: _____ TANK #: _____ MASK #: _____ HYDROSTATIC TEST DATE: _____

Component	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	COMMENTS
Air Cylinder & Valve													
Facepiece Lens & Rims													
Facepiece Head Straps													
Facepiece Skirt													
Facepiece Buckles													
Facepiece Inlet Nozzle													
Gauge/Alarm													
1st Stage Reg & Hose													
2nd Stage Reg & Hose													
Harness/Frame													
Date													
Initials													

Note: A check mark indicates that each component was inspected as per guidelines and that the component passed inspection

SCBA UNIT INSPECTION LOG

YEAR: ___________ TANK #: ___________ HYDROSTATIC TEST DATE: ___________

Component	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	COMMENTS
Air Cylinder & Valve													
Date													
Initials													

YEAR: ___________ TANK #: ___________ HYDROSTATIC TEST DATE: ___________

Component	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	COMMENTS
Air Cylinder & Valve													
Date													
Initials													

YEAR: ___________ TANK #: ___________ HYDROSTATIC TEST DATE: ___________

Component	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	COMMENTS
Air Cylinder & Valve													
Date													
Initials													

Note: A check mark indicates that each component was inspected as per guidelines and that the component passed inspection

____

____

SCBA UNIT INSPECTION LOG

YEAR: _____ TANK #: _____

Component	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	COMMENTS
Facepiece Lens & Rims													
Facepiece Head Straps													
Facepiece Skirt													
Facepiece Buckles													
Facepiece Inlet Nozzle													
Date													
Initials													

YEAR: _____ TANK #: _____

Component	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	COMMENTS
Facepiece Lens & Rims													
Facepiece Head Straps													
Facepiece Skirt													
Facepiece Buckles													
Facepiece Inlet Nozzle													
Date													
Initials													

Note: A check mark indicates that each component was inspected as per guidelines and that the component passed inspection

Appendix I

Calculated Cartridge Life Expectancies

North Cartridge Life Estimation

http://www.northsafety.com/TriggerWorkflow.aspx?WorkflowModuleGUID=a3c3bf34-f500-45aa-a73f-13a246669a21&Alias=NSUS&SB_ContentItemGuid=e985936e-23c2-4a6a-ba14-8dc17277a43f&ReuseToken=True&CDTID=1e233702-0176-4244-8ff3-376802314de1

Recommended Change-out Cycle for Non-IDLH Atmospheres

EHSEM recommends that the cartridge be replaced after 8 hours of continuous use, or 6 months of non-continuous use. It should also be changed-out when there are signs of breakthrough or clogging.

Formaldehyde

The Occupational Safety and Health Administration's (OSHA's) General Industry Standard for Formaldehyde, 29 CFR 1910.1048, has specific cartridge change out requirements located specifically at 29 CFR 1910.1048(g)(2)(ii)(A). Therefore, a cartridge change out calculation is not calculated and the requirements of the standard are followed when cartridge respirators are used. Engineering measures such as closed processes, local exhaust ventilation, or chemical substitution will be used as the primary means of controlling air contaminants. The requirements of this program will be followed when engineering controls are not adequate, or during implementation of engineering controls.

Formaldehyde cartridge change outs will be done after 3 hours of use or at the end of the work shift, whichever occurs first, unless the cartridge contains a NIOSH approved end-of-service-life indicator (ESLI) to show when break through occurs.

Example SurvivAir Cartridge End of Service Life Calculator Report – Xylene

See following page for example xylene SurvivAir End of Service Life Calculator print-out.

Survivair Respirator Cartridge Service Life Estimate

Employee Information

Employee Name:	**John Doe**
Date:	**2/6/2004**
Employee Number:	**NA**
Job Title/Job Description:	**Operations**
Employer:	**University of Michigan**
Employer Location/Address:	**Ann Arbor**
Comments:	**This is an example Cartridge Service Life Estimate**
	Calculation for display purposes only

Estimated Cartridge Service Life

Survivair Cartridge Model:	**1051**
Estimated Service Life:	**9.17 Hours**
	550.41 Minutes

Contaminant Information

Contaminant Name:	**m-Xylene**		
Contaminant CAS Number:	**108-38-3**		
Permissible Exposure Limits:	**Exposure Limit (PEL, TLV, WEEL):**	**100.0000**	**ppm**
	STEL (OSHA, TLV):	**150.0000**	**ppm**
	Ceiling (OSHA, TLV):		**ppm**
	IDLH:	**900.0000**	**ppm**

Work Site Parameters

Contaminant Concentration:	**250.0000 ppm**
Temperature:	**26.7 `C**
Relative Humidity:	**66% to 80%**
Work Rate:	**Moderate - continuous movement (50 lpm)**
Safety Factor:	**None**

THE YOON-NELSON MODEL

The Yoon-Nelson model is a descriptive model that uses experimental data to calculate parameters that are then entered into the model.

1. Yoon, Y.H., J.H. Nelson, Breakthrough Time and Adsorption Capacity of Respirator Cartridges, *American Industrial Hygiene Association Journal*, 53:303-316 (1992).

- **The basic equation for the model is:**

$$t = \tau + \frac{1}{k'} \ln \frac{P}{1-P}$$

t = breakthrough time (min)
T = 50% contaminant breakthrough time (min)
k' = rate constant (min-1)
P = probability of contaminant breakthrough.

- **The value of T is determined from experimental data.**

  The value of k' has been shown to be related to T by the following formula:

$$k' = \frac{k}{\tau}$$

k = proportionality constant that is constant independent of concentration and varies only slightly with humidity.

- **The value of T is related to the contaminant concentration by the equation:**

$$\log \tau = K'' - a \log C_I$$

K", a = constants that can be derived from experimental data. They vary with humidity, but for humidities ≤ 50% they are essentially constant.
C_I = contaminant assault concentration. (ppm)

- **It is possible to determine the constants k, K", and a from a minimum of 3 experimental data points. However, the inclusion of additional data points increases the accuracy of the model.**

Appendix J

UNIVERSITY OF MICHIGAN – DEARBORN RESPIRATOR PROGRAM ASSESSMENT PROTOCOL

1.Program Administration

a. Does the facility have a written respirator program? Yes___ No ___
Comments: …….

b. Has a single individual been designated as Program Administrator for the respiratory protection program?
Comments: ……. Yes___ No ___

c. Does the Program Administrator have sufficient knowledge of respiratory protection?
Comments: ……. Yes___ No ___

2.Respirator Selection

a. Are there written standard operating procedures governing the selection and use of respirators?
Comments:……. Yes___ No ___

b. Are written worksite-specific procedures used to specify the type of respirator used for work tasks and emergencies?
Comments:……. Yes___ No ___

c. Are only NIOSH approved respirators authorized for use?
Comments:…….
Yes___ No ___

3.Medical Evaluation

a. Does each respirator user receive a medical evaluation to determine the user's physical and psychological ability to wear a respirator?
Comments:……. Yes___ No ___

b. Is the PLHCP provided with supplemental information concerning the frequency and duration of respirator use and conditions of use in the work environment?
Comments:……. Yes___ No ___

4.Fit Testing

a. Are fit tests performed by qualified persons on an annual basis?
Comments:……. Yes___ No ___

b. Are fit tests performed on all tight-fitting facepieces according to established fit test protocols?
Comments:……. Yes___ No ___

c. Are a sufficient number of respirator models and sizes available to correctly fit respirator wearers?
Comments:…….

d. Have employees been instructed in how to conduct negative and positive pressure seal checks and can employees demonstrate the ability to carry out the seal check? Yes___ No ___
Comments:…….

e. Is a policy in place concerning facial hair and the use of respirators?
Comments:…….

Yes___ No ___

5.Maintenance, Care and Use

a. Are respirators regularly cleaned and disinfected according to established procedures? Yes___ No ___
Comments:…….

b. Are respirators properly stored when not in use and are adequate storage facilities available to prevent respirator contamination?
Comments:……. Yes___ No ___

c. Are emergency use respirators stored in compartments clearly marked as containing emergency use respirators?
Comments:……. Yes___ No ___

d. Are respirators regularly inspected according to established procedures?
Comments:…….
Yes___ No ___

e. Is there a program in place to inspect emergency use respirators on a monthly basis?
Comments:…….
Yes___ No ___

f. Are monthly inspections of emergency use respirators properly documented by use of tags or inspection reports which detail the date of inspection, inspector's name, findings, remedial action taken and serial number of inspected respirator? Yes___ No ___
Comments:…….

g. Are respirators maintained and repaired by experienced or authorized individuals in accordance with established procedures?
Comments:……. Yes___ No ___

6.Air Quality

a. Are breathing air supply stations inspected on a quarterly basis and are they installed and maintained in accordance with established engineering specifications? Yes___ No ___
Comments:…….

b. Are all breathing air supply stations clearly labeled and are all breathing gas cylinders marked in accordance with the NIOSH respirator certification standard, 42 CFR Part 84? Yes___ No ___
Comments:…….

c. Are the compressors used to supply breathing air properly situated and equipped in order to provide cylinders and air supply stations with minimum requirements for Type 1 Grade D breathing air? Yes___ No ___
Comments:…….

7.Training

a. Are employees who wear respirators trained before initial respirator use and at least annually thereafter? Yes___ No ___
Comments:…….

b. Does the training program include the following elements:
c. The proper use, limitations and capabilities of the respirator.
d. Proper use in emergencies. Yes___ No ___
e. Information on inspection, how to put on and remove the respirator, seal checks, maintenance and storage.
f. How to recognize symptoms that impact respirator use.
g. General requirements of 1910.134.
Comments:…….

h. Are employees provided additional hands-on instruction for proper respirator use in conjunction with fit-testing sessions?
Comments:……. Yes___ No ___

8. Program Evaluation

a. Are periodic evaluations of the respirator program conducted including a formal evaluation that is conducted at least annually?
Comments:…….
Yes___ No ___

b. Are employees who use respirators regularly consulted in order to determine respirator program effectiveness?
Comments:…….
Yes___ No ___

9. Recordkeeping

a. Are records available to show that employees who use respirators have been trained?
Comments:…….
Yes___ No ___

b. Are records available to show that respirator users have been medically evaluated to determine their ability to wear respirators?
Comments:…….
Yes___ No ___

c. Are records of fit testing available and do the records include the employees name, the type of test administered, test date, respirator size and type and fit test results?
Comments:…….
Yes___ No ___

d. Are records available to show that emergency use respirators are inspected monthly?
Comments:…….
Yes___ No ___

e. Are records available showing a certificate of analysis for purchased breathing air cylinders?
Comments:…….
Yes___ No ___

f. Are records available documenting the replacement of filters for the breathing air supply system?
Comments:……. Yes___ No ___

g. Are records available to document that the respirator program is being evaluated to determine the program's effectiveness?
Comments:……. Yes___ No ___

Assessment Completed by: _____
Date Completed: _____

Appendix K

RESPIRATOR USER SURVEY FORM

Name (Optional): _____ UM ID#: _____
Dept. Name: _____
Job Title: _____

You have been identified as a user of respiratory protection at the University of Michigan-Dearborn. This survey contains several questions about your use of respirators and should be relatively easy to complete. The purpose of the survey is to help evaluate the effectiveness of our respirator program. Please take a few minutes of your time and respond to the questions as appropriate. Thank you for your help in completing this survey.

If you answer "No" to any of the following questions, please provide comments and indicate the type of respirator you are referring to.

---

1. **For respirators with tight fitting facepieces: Does the respirator you wear fit properly and maintain a good seal with your face?** **Yes____ No____**

Improvement Suggestions / Comments: (please provide which respirator if you answered no)
……
……

2. **By their nature, respirators may have some impact on your vision, hearing, communication or ability to move about. Other than some minor impact, does the respirator you wear allow you to perform your work effectively?** **Yes____ No____**

Improvement Suggestions / Comments: (please provide which respirator if you answered no)
……
……

3. **Is the respirator you wear appropriate for the hazards of your job; in other words, does it provide you with adequate respiratory protection?** **Yes____ No____**

Improvement Suggestions / Comments: (please provide which respirator if you answered no)
……
……

4. **Is the respirator you wear maintained in good condition; in other words, is it stored properly, cleaned properly and repaired promptly when necessary?** **Yes____ No____**

Improvement Suggestions / Comments: (please provide which respirator if you answered no)
……
……

5. **It is important to wear and use a respirator properly under the workplace conditions you encounter. Do you…**

   A. Inspect your respirator before each use? **Yes____ No____**
   B. Perform a User Seal Check before each use? **Yes____ No____**

Improvement Suggestions / Comments: (please provide which respirator if you answered no)
……
……

6. **Do you smell chemical odors while wearing cartridge respirators?**

   Circle the response that best describes your answer.

Almost always		Sometimes		Almost never
1	2	3	4	5

Improvement Suggestions / Comments: (please provide if you answered in category 1 or 2)
……
……

7. **How satisfied are you with the respirator program in general, which includes such elements as proper selection, fit testing, training, maintenance, cleaning and storage?**

   Circle the response that best describes your answer.

Not satisfied		Satisfied		Very satisfied
1	2	3	4	5

Improvement Suggestions / Comments: (please provide if you answered in category 1 or 2)
……
……

Appendix L

MIOSHA Respirator Assigned Protection Factors (*Non-escape Conditions*)

Employers must use the assigned protection factors listed in the Table below. Select a respirator that meets or exceeds the required level of employee protection.

Type of Respirator[1,2]	Half Mask	Full Facepiece	Helmet	Loose-Fitting Facepiece
1. Air-Purifying Respirator (APR)	10[3]	50	–	–
2. Powered Air-Purifying Respirator (PAPR)	50	1,000	25	25
3. Supplied-Air Respirator (SAR) or Airline Respirator				
• Demand mode	10	50	–	–
• Continuous flow mode	50	1,000	25	25
• Pressure-demand or other positive-pressure mode	50	1,000	–	–
4. Self-Contained Breathing Apparatus (SCBA)				
• Demand mode	10	50	50	–
• Pressure-demand or other positive-pressure mode	–	10,000	10,000	–

Notes:

1. Employers may select respirators assigned for use in higher workplace concentrations of a hazardous substance for use at lower concentrations of that substance, or when required respirator use is independent of concentration.

2. The assigned protection factors in the Table above are only effecting when the employer implements a continuing, effective respirator program as required by MIOSHA Part 451 / OSHA 29 CFR 1910.134, including training, fit testing, maintenance, and use requirements.

3. This APR category includes filtering facepieces, and half masks with elastomeric facepieces.