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SUMMARY: The Respiratory Protection Guideline provides the University community with the necessary information to understand respiratory protection requirements and the means to obtain proper respiratory protection from OSEH. 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 OSEH. Filtering facepieces, i.e., Dust Masks, used for nuisance dust activities can be obtained through OSEH or purchased through M-marketsite.

SCOPE: This Guideline applies to all University employees that utilize respiratory protection. University of Michigan Health System (UMHS) / Hospital employees are also covered by this Guideline except for the use of N95 dust mask respirators for protection against infectious diseases. This type of respirator use is covered under UMHS’ Respiratory Protection Program.

The University’s Scientific Diving Program covers the use of Self-Contained Underwater Breathing Apparatus (SCUBA).

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 alone 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 (MIOSHA Part 451)
- Respiratory Protection and Controls to Restrict Internal Exposure in Restricted Areas (10 CFR 20 / Subpart H)

DEFINITIONS:

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.

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.

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, e.g., a disposable particulate respirator rated as N95 (at least 95% efficient to remove particles greater than 0.3 micrometers (µm) in diameter).

End-of-Service-Life Indicator (ESLI) – A system that warns the respirator user of the approach of the end of adequate respiratory protection; for example, that the sorbent is approaching saturation or is no longer effective.

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 a “dust mask” (see definition above). Filtering facepieces are available through OSEH or purchased through M-marketsite.

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

High Efficiency Particulate Air (HEPA) Filters – Filters capable of trapping and retaining at least 99.97% of all particles of 0.3 micrometers (µm) in diameter. The equivalent NIOSH 42 CFR 94 particulate filters are the N100, R100, and P100 filters.

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, i.e., license, registration, or certification, allows him or her to independently provide or be delegated the responsibility to provide some or all of the health care services 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 the NIOSH certification tests, in which adequate breathing gas is supplied.
RESPONSIBILITY: OSEH

Document and administer the respirator program.

Assess the degree of hazard associated with respiratory exposures and the need for respiratory equipment.

Coordinate respirator purchasing, disbursement, fit testing and training.

Provide University’s medical provider with information on individual type of respirator, duration and frequency of use, physical work effort, other Personal Protective Equipment (PPE) worn and if any temperature or humidity extremes exist in work environment for the purposes of employee medical clearance and surveillance related to this program.

Provide technical assistance upon request.

Evaluate and recommend cartridge change-out schedules.

Schedule and maintain records of all medical surveillance services.

Maintain records of hazard evaluations including the maintenance of employee exposure data collected.

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 Danielle Sheen, Associate Director (7-1142 or drsheen@umich.edu).

Supervisors

Identify jobs requiring respiratory protection and inform employees of these requirements;

Assure that employees are issued respiratory protection through the procedures outlined in this Guideline as well as ensure that all employees engaged in such work use the appropriate respirators when required, and follow the elements of this program;

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

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 the OSEH department immediately.

Attend scheduled training and fit testing.

PROCEDURES:

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

1. Hazard determination and equipment selection;
2. Employment status and medical clearance;
3. Fit Testing and Fit Checking;
4. Maintenance, care, and use of respiratory equipment;
5. Assurance of appropriate air quality for air supplying respirators;
6. Annual training on respirator use;
7. Program evaluation; and
8. 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. The OSEH Representative for the area 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 and/or supervisors shall contact the OSEH Representative for their area 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 designated by the OSEH Representative that will be 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 assigned protection factors (APFs), maximum use concentrations (MUCs) and an individual’s fit test results; and

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 OSEH Representative making the equipment selection is encouraged to use the selection process noted in the “NIOSH Respirator Selection Logic.” Also refer to Appendix A “MIOSHA Respirator Assigned Protection Factors” and Appendix B, “Respirator Equipment Selection Guidance and the NIOSH Respirator Selection 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 OSEH for individuals not on the University payroll. If other individuals wish to use respirators, OSEH will provide a list of safety supply companies upon request.

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. OSEH 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 will fill out and submit online a **Medical Surveillance Request Form.** Upon OSEH’s review and approval, the employee will be sent a questionnaire that must be completed during normal working hours and in a confidential manner and returned to the clinic. OSEH will also provide to the PLHCP information on individual types of respirators, duration and frequency of use, physical work effort, other Personal Protective Equipment (PPE) worn and the temperature and humidity extremes that exist in the work environment for the PLHCP’s determination consideration.

   b. 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 appointment in this case.

   c. Approval, non-approval, and any medical restrictions for an employee regarding respirator use will be communicated to the OSEH Department 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. OSEH 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, e.g., every one to three years. OSEH will notify the supervisor 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, 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; and
      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, under certain conditions. They will have an initial medical evaluation through the use of the medical questionnaire only. The frequency of any re-evaluations, e.g., every one to three years, will be determined by a physician. Re-evaluations may include only the medical questionnaire or may include a physical examination. 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 TESTING AND FIT CHECKING – 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 with the seal of the facepiece). All voluntary users of tight-fitting respirators will receive initial fit testing. The voluntary use of dust masks/filtering facepieces do not require fit testing.

Additional fit testing will be conducted whenever the employee, supervisor, physician, or OSEH Representative/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 OSEH. The employee and his/her supervisor will be notified of the appointment via e-mail. OSEH 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. OSEH 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. (Refer to OSEH’s Procedures for Obtaining Prescription Safety Glasses.)

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 acrylonitrile, methylene chloride, 1,2-dibromo-3-chloropropane, ethylene oxide, and methylene dianiline.

**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 or the valve function 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 one qualitative or quantitative 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 facepieces 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 facepiece collapses slightly, and no inward leakage of air into the facepiece 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 facepiece without detection of any outward air leak between the sealing surface of the facepiece 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: OSEH uses quantitative fit testing in lieu of qualitative fit tests when feasible.
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 C, “Qualitative Fit Testing Option Guidance,” for guidance on acceptable qualitative fit testing circumstances. Below is a type of qualitative fit test protocol that may be used:

i. Bitrex™ (Denatonium Benzoate) / Saccharin Test: The employee is exposed to either Bitrex (creates an unmistakable bitter taste) or Saccharin (produces a sweet taste) while wearing a respirator equipped with particulate filters. If the wearer detects odor or taste, an adjustment to the respirator is necessary.

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 D – Information for Voluntary Users of Respirators
b. Appendix E – Inspection Guidance for Air-Purifying Respirators (APRs)

c. Appendix F – Respirator Training Information (For all Respirators except PAPRs, SARs, and SCBAs)
d. Appendix G – Specific Procedures for the Use of Powered Air-Purifying Respirators (PAPRs)

e. Appendix H – Specific Procedures for Use of Supplied-Air Respirators (SARs): (Currently, there are no users of SAR units at the University of Michigan. 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 I – Specific Procedures for Use of Self-Contained Breathing Apparatus (SCBA)

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 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, OSEH generally recommends that gas/vapor cartridges be changed every six months, at a minimum. Cartridges designed for protection against particulates, e.g., HEPA filters, should be changed out once breathing resistance is noted, or every six months, whichever comes first. The OSEH 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. The following manufacturers of respirators used at the University have made cartridge life expectancy calculators available at the following links:

      i. **SURVIVAIR®** – Use the S-Series Cartridge Service Life Software link available within the Software Downloads section. (*Must create an account to download.*):
         http://www.honeywellsafety.com/Pages/Product.aspx?id=1466&site=/americas

      ii. **North/Honeywell** – Respiratory and hand protection selection guide that includes a respirator cartridge life expectancy calculator. (*Must create an account to download.*):
         http://www.honeywellsafety.com/

      iii. **Scott** – SureLife™ Cartridge Calculator is a cartridge selection and service life estimation tool. (*Must create an account to use.*):

   ii. Please refer to Appendix J for contaminant specific end-of-service-life information as well as an example printout from the SURVIVAIR® ESLI calculator using m-xylene.

   iii. 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 greater than 70°C (158°F) 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.

   iv. OSHA also has also developed a for calculating change out schedules:
v. 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 code.

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.

1. The fit test record and training documentation form used during the annual training and fit test event should include a place for the fit test technician to fill in the applicable cartridge change-out information, which he/she will obtain from the “Information to Physician” document.

vi. Replacement cartridges are available at the OSEH office.

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.

1. These requirements include:
   a. Oxygen (O₂) content of 19.5 – 23.5%;
   b. Hydrocarbon (condensed) content of 5 milligrams per cubic meter (mg/m³) of air or less;
   c. Carbon monoxide (CO) content of 10 ppm or less;
   d. Carbon dioxide (CO₂) content of 1,000 ppm or less; and
   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 (-45.6°C) at one atmosphere pressure.

3. See the attachments entitled, “Specific Procedures for Use of Self-Contained Breathing Apparatus” (Appendix I) and “Specific Procedures for Use of Supplied-Air Respirators” (Appendix H) for air quality information specific to those protective devices.

F. ANNUAL TRAINING ON RESPIRATOR USE – For respirators other than PAPRs, SARs, and SCBAs, employees will be trained by OSEH staff on proper respirator usage at the time of fit testing. Voluntary users of respirators (including filtering facepieces) will be supplied, at a minimum, with MIOSHA “Information for Voluntary Users of respirators” information located in Appendix D. It is suggested that supervisors 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; and
   f. Potential adverse medical effects of respiratory use.
2. See Appendix F for training information on respirators other than PAPRs, SARs, and SCBAs and a checklist used for training.

3. Employees designated as authorized users of SCBA during emergencies must attend the initial OSEH Emergency Response Training Program and at least semi-annually attend refresher training for SCBA usage. This training will include practice putting on and removing the SCBA under the observation of the OSEH department.

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 Assessment Protocol” form found in Appendix K.

2. Respirator user consultations via a survey of randomly selected respirator wearers will be done using the “Respirator User Survey Form” located in Appendix L. 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; and
   d. Proper respirator maintenance.

H. RECORDKEEPING

1. Training
   a. The OSEH department will maintain 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 OSEH for the duration of the employee’s employment plus 30 years.

3. Fit Testing
   a. The OSEH department 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 and University of Michigan ID (UMICH ID) number, if available, of the person tested;
      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 type and amount of cartridges and/or filters issued;
      vi. The success or failure of the person to obtain a satisfactory fit during the test;
      vii. The signature of OSEH representative administering the test; and
viii. The signature of the tested individual indicating he/she was fit tested and trained on proper usage, cleaning, storage, and limitations of the respirator.

4. Inspection
   a. Emergency use respirators will be inspected monthly 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. The OSEH department will maintain the records related to the periodic evaluation of the program effectiveness and implementation for at least 2 years.

6. Air Quality
   a. OSEH’s Hazardous Materials Management (HMM) arranges for semi-annual inspections of breathing air through an outside contractor. Certifications generated are kept on file at the NCTF (North Campus Transfer Facility) located at 1655 Dean Road. The air supply unit monitors for carbon monoxide (CO) and moisture content electronically.
   b. HMM will maintain a log on the unit that will list the last inspection date and the date of the next inspection.
   c. Purification cartridge change-out will be done when the need is indicated on the filter restriction gauge. This gauge will be visually checked during the monthly inspection.

RELATED DOCUMENTS: OHSA’s Assigned Protection Factors for the Revised Respiratory Protection Standard

TECHNICAL SUPPORT: All referenced Guidelines, regulations, and other documents are available through OSEH (7-1142). Assistance in hazard evaluation, Medical Surveillance, and selection of respirators is also provided by OSEH.
Appendix A

MIOSHA Respirator Assigned Protection Factors (Non-escape Conditions)

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

<table>
<thead>
<tr>
<th>Type of Respirator</th>
<th>Half Mask</th>
<th>Full Facepiece</th>
<th>Helmet</th>
<th>Loose-Fitting Facepiece</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Air-Purifying Respirator (APR)</td>
<td>$10^3$</td>
<td>50</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>2. Powered Air-Purifying Respirator (PAPR)</td>
<td>50</td>
<td>1,000</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>3. Supplied-Air Respirator (SAR) or Airline Respirator</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Demand mode</td>
<td>10</td>
<td>50</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>• Continuous flow mode</td>
<td>50</td>
<td>1,000</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>• Pressure-demand or other positive-pressure mode</td>
<td>50</td>
<td>1,000</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>4. Self-Contained Breathing Apparatus (SCBA)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Demand mode</td>
<td>10</td>
<td>50</td>
<td>50</td>
<td>—</td>
</tr>
<tr>
<td>• Pressure-demand or other positive-pressure mode</td>
<td>—</td>
<td>10,000</td>
<td>10,000</td>
<td>—</td>
</tr>
</tbody>
</table>

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 effective 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 APF category includes filtering facepieces, and half masks with elastomeric facepieces.
Appendix B

Respirator Equipment Selection Guidance and the NIOSH Respirator Selection Logic Process

As stated in this Guideline, the OSEH Representative for specific University departments/areas are encouraged to use the NIOSH Respirator Selection Logic Process to aid in the proper selection of respiratory protective devices.

Selection 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.

The entire NIOSH Respirator Selection Logic guideline document is available online via the following link: https://www.osha.gov/OshDoc/Directive_pdf/CPL_02_02-075.pdf.

In addition to the NIOSH Respirator Selection Logic and the information collected, the OSEH Representative will also use Table 1 below as a guide in selection when the following hazards exist:

<table>
<thead>
<tr>
<th>HAZARD</th>
<th>MINIMUM REQUIRED RESPIRATOR, CARTRIDGES, AND FILTERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen (O₂) Deficiency</td>
<td>Self-Contained Breathing Apparatus (SCBA)</td>
</tr>
<tr>
<td>Gas, Vapor, Particulate Contaminants</td>
<td></td>
</tr>
<tr>
<td>Atmospheres Immediately Dangerous to Life or Health (IDLH)</td>
<td>Self-Contained Breathing Apparatus (SCBA)</td>
</tr>
<tr>
<td>Atmospheres not Immediately Dangerous to Life or Health (IDLH)</td>
<td>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.</td>
</tr>
<tr>
<td>Asbestos / Lead</td>
<td>• Half mask with HEPA filter;</td>
</tr>
<tr>
<td></td>
<td>• Full facepiece with HEPA filter; and</td>
</tr>
<tr>
<td></td>
<td>• PAPR with HEPA filter.</td>
</tr>
<tr>
<td></td>
<td>• HEPA/particulate filters must be rated at N100 (no oil present), R100, or P100 (oil present)</td>
</tr>
<tr>
<td>Pepper spray or other crowd control agent</td>
<td>Gas Mask (CS/CN P100 Respirator) with gas canister</td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>Half or Full-facepiece with a formaldehyde cartridge</td>
</tr>
<tr>
<td></td>
<td>NOTE: If eye discomfort is experienced, than a full-facepiece is required.</td>
</tr>
<tr>
<td>Isocyanates</td>
<td>Self-Contained Breathing Apparatus (SCBA) or</td>
</tr>
<tr>
<td></td>
<td>Supplied-Air Respirator (SAR)</td>
</tr>
<tr>
<td>HAZARD</td>
<td>MINIMUM REQUIRED RESPIRATOR, CARTRIDGES, AND FILTERS</td>
</tr>
<tr>
<td>---------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Ethylene Oxide</td>
<td>Up to 5 ppm: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister. NOTE: End of service life indicator (ESLI) required.</td>
</tr>
<tr>
<td>Solvents</td>
<td>Half or Full facepiece with organic vapor cartridges</td>
</tr>
<tr>
<td>Mercury Vapor</td>
<td>Half or Full facepiece with mercury vapor cartridges</td>
</tr>
<tr>
<td>Silica</td>
<td>Half or Full facepiece with HEPA filter rated at N100 or P100</td>
</tr>
<tr>
<td>Welding Fumes</td>
<td>Welding respirator with HEPA filter N95 (no oil), R95 or P95 (oil present)</td>
</tr>
</tbody>
</table>
| Infectious Agents, i.e., Pathogenic micro-organisms that can be transmitted via air and can cause disease in humans – includes Tuberculosis (TB), pigeon excrement, Severe Acute Respiratory Syndrome (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) | • N95 Disposable Particulate Respirator |
Appendix C

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” and modified to reflect those respirators used at the University of Michigan.

Table 1
Acceptable Fit-Testing Methods

<table>
<thead>
<tr>
<th>Respirator Type</th>
<th>QLFT</th>
<th>QNFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Half Face, Negative Pressure, APR (&lt; 100 fit factor)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Full Face, Negative Pressure, APR (&lt; 100 fit factor) used in atmospheres up to 10 times the PEL</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Full Face, Negative Pressure, APR (&gt; 100 fit factor)</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Positive Air-Purifying Respirator (PAPR)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Supplied-Air Respirators (SAR), or SCBA used in Positive Pressure (Pressure Demand Mode)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Loose-fitting Respirators, e.g., hoods, helmets</td>
<td>Fit-testing not required</td>
<td></td>
</tr>
</tbody>
</table>
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 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 exposure limits, 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 OSEH are certified by NIOSH and are designed to protect against specific contaminants. Obtain all respiratory protection through OSEH 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 OSEH to re-evaluate your protection; and

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

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. Also refer to the Respirator Training Information Checklist for additional training information.

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 (< 19.5% O₂).

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. Facial hair that does not interfere with the seal or the valve function of the respirator may be allowed.

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 OSEH to the manufacturer.
6. OSEH 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 (49°C [120°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 (49°C [120°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 49°C (120°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 49°C (120°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.

4. Rinse components thoroughly in clean, warm 49°C (120°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.

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

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

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

8. OSEH recommends the use of respirator refresher pads to disinfect the respirator.
Storage of Respirators

When not in use, the respirator and cartridges should be kept in a sealed plastic bag 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 should also be protected from dust and dirt to enhance 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 work stations 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 months or per the cartridge change-out schedule determined by the area specific OSEH representative 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 months or used until breathing resistance increases to an uncomfortable level. For cartridges with an End-of-Service-Life Indicator (ESLI), e.g. mercury, replace the cartridges when indicated by color change.

NOTE: Please refer to Appendix J for contaminant specific end-of-service-life information as well as an example printout from the SURVIVAIR® ESLI calculator using m-xylene.

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 or valve function. 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 pounds or more), the employee shall be fit tested again.

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 acrylonitrile, methylene chloride, 1,2-dibromo-3-chloropropene, ethylene oxide, and methylene dianiline.

Hard, nonpermeable lenses shall not be worn with full-facepiece respirators.

OSEH recommends frequent breaks if a respirator is to be worn for any length of time.
<table>
<thead>
<tr>
<th>Respiratory Hazard</th>
<th>Examples</th>
<th>Health Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen (O₂) Deficiency</td>
<td>May exist in confined spaces such as tanks, wells, and pits.</td>
<td>Effects range from slightly impaired coordination and breathing effects to nausea, vomiting, &amp; unconsciousness, to death within minutes depending on percentage of O₂ in the air.</td>
</tr>
<tr>
<td>Asphyxiants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simple – Materials that displace O₂ in the air to create an O₂ deficiency.</td>
<td>Simple – nitrogen (N₂), hydrogen (H₂), methane (CH₄), helium (He), neon (Ne), argon (Ar)</td>
<td>See O₂ Deficiency (above)</td>
</tr>
<tr>
<td>Chemical – Materials that act to render the body unable to utilize O₂</td>
<td>Chemical – carbon monoxide (CO), hydrogen (H₂), hydrogen sulfide (H₂S), nitriles</td>
<td></td>
</tr>
<tr>
<td>Carcinogens</td>
<td>Gas/Vapor – benzene, carbon tetrachloride, vinyl chloride</td>
<td>Development of cancer(s) after a period of time.</td>
</tr>
<tr>
<td></td>
<td>Particulate – radioactive particulate, asbestos, chromates</td>
<td></td>
</tr>
<tr>
<td>Irritants</td>
<td>Gas/Vapor – ammonia (NH₃), hydrogen chloride (HCl), sulfur dioxide (SO₂), hydrogen sulfide (H₂S), chlorine (Cl₂), ozone (O₃)</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>Particulate – fiberglass, acidic mists, alkali mists</td>
<td></td>
</tr>
<tr>
<td>Systemic Poisons</td>
<td>Gas/Vapor – mercury (Hg), lead (Pb), hydrogen sulfide (H₂S), organic solvents, pesticides, ethylene oxide, ether, carbon tetrachloride, chloroform, benzene, carbon disulfide</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>Particulate – lead (Pb), cadmium (Cd), pesticides</td>
<td></td>
</tr>
<tr>
<td>Allergy-producing</td>
<td>Animal furs, pollens, molds, formaldehyde, pesticides, ethylenediamine</td>
<td>Reactions may include itching, sneezing, and asthma. Other hypersensitive reactions may also occur. Skin contact may also be a concern.</td>
</tr>
<tr>
<td>Respiratory Hazard</td>
<td>Examples</td>
<td>Health Effects</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>---------------------------------------</td>
<td>---------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Pulmonary-fibrosis producing</strong></td>
<td>Silica, asbestos</td>
<td>Fibrotic disease in lungs</td>
</tr>
<tr>
<td><strong>Febrile-producing</strong></td>
<td>Fumes of zinc (Zn), iron (Fe), and copper (Cu) (usually associated with welding)</td>
<td>Flu-like disorder with fever and chills that typically last 24 to 48 hours.</td>
</tr>
<tr>
<td><strong>Nuisance particulate</strong></td>
<td>Construction dust, plaster dust, ceramics, sawdust</td>
<td>May cause discomfort and irritation but usually not associated with causing any adverse health problems.</td>
</tr>
<tr>
<td><strong>Infectious Agents</strong></td>
<td>Pathogenic microorganisms that are transmitted through air and can cause disease in humans.</td>
<td>Tuberculosis (TB), pigeon excrement</td>
</tr>
</tbody>
</table>
## Respirator Training Information Checklist

<table>
<thead>
<tr>
<th>USE</th>
<th>Why the respirator is necessary: Include general information on hazards of substance.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>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 assess comfort.</td>
</tr>
<tr>
<td></td>
<td>Inspection: Should be performed before each use- Check valves, headstraps, facepiece, etc. for any defects. All problems must be replaced/repaired before use, Call OSEH for parts.</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>Seal check: Positive and negative pressure checks must be done each time the respirator is used.</td>
</tr>
<tr>
<td></td>
<td>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 interferes with the sealing areas of the respirator.</td>
</tr>
<tr>
<td></td>
<td>How improper fit, usage, or maintenance can compromise the protection provided by the respirator.</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>Medical signs and symptoms: Respirator use may cause increased physiological stress on the heart and lungs. This is why all respirator 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/OSEH. In addition, you may need an additional medical examination if your personal health status has changed in any way that may affect your respirator use.</td>
</tr>
</tbody>
</table>

| CARTRIDGES | Cartridges are designed for specific contaminants. The cartridges issued are selected according to the particular substance that will be used. Consult OSEH 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 the following frequency as determined by an OSEH Representative for your exposure situation: ___________________________. For cartridges with an 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 filters 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 G

Specific Procedures for the Use of Powered Air-Purifying Respirators (PAPRs)

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.

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 OSEH.

PAPRs will not be utilized for situations where the hazardous substance lacks adequate warning properties (odor or taste), 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 OSEH at 7-1142 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 by OSEH 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. A tight-fitting PAPR user must attend OSEH training at the time of fit testing and will receive refresher training from OSEH annually. For those mandatory users wearing loose-fitting systems that do not receive annual fit testing, OSEH will conduct separate training on an annual basis; and

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 (Refer to OSEH’s Procedures for Obtaining Prescription Safety Glasses.) 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 acrylonitrile, methylene chloride, 1,2-dibromo-3-chloropropene, ethylene oxide, and methylene dianiline.

Hard, nonpermeable lenses shall not be worn with full-facepiece respirators.
Current authorized users of PAPRs include the following:

1. **Tight-Fitting PAPR:**
   a. Asbestos removal trained personnel in Plant Operations
   b. Personnel assigned PAPR for medical reasons per Physician

2. **Loose-fitting PAPR:**
   a. Buhr Conservation Personnel
   b. Plant Department Paint Shop personnel
   c. Members of the Emergency Response Team
   d. ULAM personnel assigned specific duties that require use

**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 cubic feet per minute (cfm) for tight-fitting facepieces and six 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 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 (“NiCad”) 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 losses 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 OSEH for contact information.

Battery Repair and Disposal

Some batteries can be repaired if problems arise. Consult the manufacturer or OSEH 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

OSEH should authorize purchases of PAPR systems.
Appendix H

Specific Procedures for Use of Supplied-Air Respirators (SARs)

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 or taste), 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 OSEH by calling 7-1142 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 by OSEH 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 OSEH training at the time of fit testing and will receive refresher training from OSEH annually. 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. (Refer to OSEH’s Procedures for Obtaining Prescription Safety Glasses.) 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 acrylonitrile, methylene chloride, 1,2-dibromo-3-chloropropane, ethylene oxide, and methylene dianiline.

   **Hard, nonpermeable lenses shall not be worn with full-facepiece respirators.**

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 Department of Public Safety and Security (DPSS) at 3-1131 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 Group (Argus-HAZCO)**
46400 Continental Drive
Chesterfield, MI 48047
Phone: 1-800-873-0456

**Spears Fire and Safety Services, Inc.**
287 Jackson Plaza
Ann Arbor, MI 48103
Phone: 1-734-663-4133

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

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 beads 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 (CO) 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 10 ppm in breathing air.

**New Equipment Purchases**

OSEH 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 I

Specific Procedures for Use of Self-Contained Breathing Apparatus (SCBA)

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 appendix should 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 than 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 or taste), 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 OSEH Emergency Response Training or trained OSEH staff.

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 OSEH by calling 7-1142 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 by OSEH 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 OSEH Emergency Response Training course and receive semi-annual refresher training from OSEH 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. (Refer to OSEH’s Procedures for Obtaining Prescription Safety Glasses.) 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 acrylonitrile, methylene chloride, 1,2-dibromo-3-chloropropane, ethylene oxide, and methylene dianiline.

   **Hard, nonpermeable lenses shall not be worn with full-facepiece respirators**

Current authorized users of SCBAs include:
1. Emergency Responders and other supporting units or people that can provide specialized knowledge during an emergency within departments around campus.
   a. SCBAs for emergency use are located at the North Campus Transfer Facility (NCTF) and at the Lurie Nanofabrication Facility (LNF) in the Electrical Engineering and Computer Science (EECS) Building.

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. OSEH 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 OSEH 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 Department of Public Safety and Security (DPSS) at 9-1-1 (with a campus phone) 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. DPSS will contact OSEH to 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 SCBA units and four authorized users present.** A buddy system will be used, whereby two authorized employees don SCBA and enter the emergency work area. As a backup, the other two 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 backup authorized employees with SCBA at all times, therefore, two additional authorized employees and SCBAs must be on the scene before backup personnel take any action to enter the emergency work area. OSEH and other designated 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.
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.

Cleaning

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

Inspections

All SCBAs shall be inspected at least monthly and checked for proper function before and after each use using the inspection sheet and inspection tables developed by OSEH (see attached table, below). 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, emergency responders, 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.

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 (US DOT) specification or the applicable US DOT exemption;
   a. University cylinders are made of composite construction and must be hydrostatically tested every three years. If during the inspection it is noted that hydrostatic testing is necessary again, note it on the inspection sheet and report it to OSEH-HMM.
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 affect 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 on the ERT trailer with the SCBAs and retain them for one year after inspection, then destroy.
<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>LOOK FOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>FACEPIECE LENS</td>
<td>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.</td>
</tr>
<tr>
<td>FACEPIECE RIMS</td>
<td>1. Deformed, cracked or broken rims; and 2. Loose rim screws (do not over tighten).</td>
</tr>
<tr>
<td>FACEPIECE SKIRT</td>
<td>1. Cuts, gouges, or punctures; 2. Tears or nicks in the sealing area; and 3. Deterioration from age, heat or contamination.</td>
</tr>
<tr>
<td>FACEPIECE HEAD STRAP</td>
<td>1. Abrasions or nicks; and 2. Deterioration from age, heat or contamination.</td>
</tr>
<tr>
<td>FACEPIECE BUCKLES</td>
<td>1. Crushed, bent, or corroded; and 2. Deterioration from age, heat or contamination.</td>
</tr>
<tr>
<td>FACEPIECE INLET NOZZLE</td>
<td>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.</td>
</tr>
<tr>
<td>COMPONENT</td>
<td>LOOK FOR</td>
</tr>
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<td>-----------</td>
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</tr>
</tbody>
</table>
| SECOND STAGE REGULATOR & HOSE | 1. Cracks or heat damage to housing or cover;  
2. Faulty operation of bypass valve, first breath-on, AIR KLK 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  
| 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 Group (Argus-HAZCO)**
  46400 Continental Drive
  Chesterfield, MI 48047
  Phone: 1-800-873-0456

- **Spears Fire and Safety Services, Inc.**
  287 Jackson Plaza
  Ann Arbor, MI 48103
  Phone: 1-734-663-4133

Refilling Air Cylinders

Refilling of high-pressure cylinders (4,500 psi) is arranged through OSEH-HMM (3-4568). OSEH-HMM has purchased a breathing air system for refilling cylinders and it is located at the North Campus Transfer Facility. The unit is designed to deliver Grade E air that is purer than Grade D breathing air, which is the minimum allowed by law. HMM maintains a tag and logbook system for purification cartridge change-out as well as having semi-annual testing and certification of the air by outside laboratory.

New Equipment Purchases

The purchase of new SCBA units should be consistent with the equipment used by OSEH and the Ann Arbor Fire Department. By utilizing identical equipment, OSEH and the Fire Department can more effectively assist departments in refilling cylinders, having backup cylinders available, repair work, and training. Identical equipment also provides authorized users with the ability to use buddy system breathing, should the need arise.

OSEH Equipment Specifications

1. **SURVIVAIR® Panther® CBRN certified SCBA (OSEH-HMM):**
   - Capacity/Service Time: 45-minutes,
   - NFPA-compliant,
   - NIOSH-certified for chemical, biological, radiological, and nuclear (CBRN) agents,
   - Cylinder Pressure: High Pressure (4,500 psi),
   - Carbon-fiber wrapped air cylinder,
   - Heads-Up-Display (HUD) facepiece,
   - Low-profile second stage regulator, and Carrying case and accessory kit, five strap head harness and skirt.

2. **Scott Air-Pak® 75™ CBRN certified SCBA (OSEH-ER On-Call Team):**
   - Capacity/Service Time: 60-minutes,
   - NFPA-compliant,
   - NIOSH-certified for chemical, biological, radiological, and nuclear (CBRN) agents,
   - Cylinder Pressure: High Pressure (4,500 psi / 300 Bar),
   - Full carbon-fiber wrapped, epoxy resin air cylinder,
   - Visualert Heads-Up-Display (HUD) AV-3000 facepiece with redundant low-pressure alarm,
   - Streamlined backframe,
   - Improved hose management for reduced snag hazard,
   - Dual path pressure reducer ensures constant flow of air,
   - Six-point quad adjustment head harness,
   - EPIC Voice Amplifier device transmits strong, clear, crisp voice communications,
   - Rugged, glove-friendly designed regulator, and
   - Carrying case and accessory kit
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<td>Air Cylinder No. &amp; Hydrostatic Date</td>
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<td>Facepiece Lens &amp; Rims</td>
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Note: A check mark “✓” indicates that each component was inspected as per guidelines and that the component passed inspection. An “X” indicates the component failed inspection.
SCBA AIR CYLINDER TANK INSPECTION LOG

Year: __________  Tank #: __________  Hydrostatic Test Date: __________

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<tr>
<th>COMPONENT</th>
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<th>COMMENTS</th>
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**Repair History**  
*Tanks must be hydrostatically tested every three (3) years.*

*Tanks must be replaced after 15 years of service.*
Scott AIR-PAK 75 4.5 Inspection Form

Date: _____ / _____ / _____  Name of Person Inspecting: ____________________________________

Location (circle): OSEH Vehicle 1446       LNF

### Inspection of the Breathing Air Cylinder

<table>
<thead>
<tr>
<th>U-M OSEH # (circle): 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16</th>
<th>Pass</th>
<th>Fail</th>
</tr>
</thead>
<tbody>
<tr>
<td>✅ Visually inspect breathing air cylinder and valve assembly for physical damage such as dents or gouges in metal or in composite wrapping. Cylinders which 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 which show evidence of exposure to chemicals such as discoloration, cracks in the cylinder or the composite wrapping, peeling of the outer layers of the composite wrapping and/or bulging of the cylinder wall, shall be removed from service and emptied of compressed air.)</td>
<td>_____</td>
<td>_____</td>
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<tr>
<td>✅ Hydrostatic test date is current (within 5 years)</td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>✅ Check for damage of the cylinder valve hand wheel and the threads on the cylinder valve outlet.</td>
<td>_____</td>
<td>_____</td>
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<tr>
<td>✅ Check the relief valve (burst disc) for damage or dirt.</td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>✅ Check the cylinder pressure gauge for “FULL” indication. If cylinder pressure is less than “FULL,” replace with a fully charged cylinder.</td>
<td>_____</td>
<td>_____</td>
</tr>
</tbody>
</table>

✅ Complete one form for each breathing air cylinder.
✅ This form shall be completed monthly and after every use.
✅ Any checked “fail” shall result in the SCBA being bled of all air, taken out of service, tagged, and the Office of Emergency Preparedness (OEP) notified.
Appendix J

Calculated Cartridge Life Expectancies

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. The following manufacturers of respirators used at the University have made life expectancy calculators available at the following links:

SURVIVAIR® – Use the S-Series Cartridge Service Life Software link available within the Software Downloads section. (Must create an account to download.):
http://www.honeywellsafety.com/Pages/Product.aspx?id=1466&site=/americas

North/Honeywell® – Respiratory and hand protection selection guide that includes a respirator cartridge life expectancy calculator. (Must create an account to download.):
http://www.Honeywellsafety.com/

Scott – SureLife™ Cartridge Calculator is a cartridge selection and service life estimation tool. (Must create an account to use.):

OSHA also has also developed a mathematical model for calculating change out schedules:

Formaldehyde

The Michigan Occupational Safety and Health Administration’s (MIOSHA’s) General Industry Health Standard for Formaldehyde (MIOSH Part 306) has specific cartridge change-out requirements located specifically at Part 306, R 325.51461 “Respirator Program”, Rule 11. 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.

See following page for an example m-xylene SURVIVAIR® End-of-Service-Life Calculator print-out.
Survivair® Respirator Cartridge Service Life Estimate

Employee Information
Employee Name: Jane Doe
Date: 09/20/2011
Employee Number: N/A
Job Title/Job Description: OSEH Representative
Employer: University of Michigan – OSEH
Employer Location/Address: 1239 Kipke Dr. – CSSB, Ann Arbor, MI 48109-1010

Comments: This is an EXAMPLE Cartridge Service Life Estimate Calculation for DISPLAY PURPOSES ONLY.

Estimated Cartridge Service Life
Survivair® Cartridge Model: No. 1051 (Organic Vapor / P100)
Estimated Service Life: 9.17 Hours (550.41 Minutes)

Contaminant Information
Contaminant Name: m-Xylene (synonyms: m-Xylol & 1,3-Dimethylbenzene)
Contaminant CAS Number: 108-38-3
Permissible Exposure Limits: 100 ppm (OSHA PEL-TWA, NIOSH REL-TWA, ACGIH TLV)
150 ppm (OSHA STEL, NIOSH STEL, ACGIH STEL)
900 ppm (NIOSH IDLH)

Work Site Parameters
Contaminant Concentration: 250 ppm
Temperature: 26.7 °C (80.1 °F)
Relative Humidity: 66% – 80%
Work Rate: Moderate – continuous movement (50 liters/minute)
Safety Factor: None
# Appendix K

## University of Michigan Respirator Program Assessment Protocol

### 1. Program Administration

1. Does the facility have a written respirator program?  
   
   Comments:  
   
<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
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</thead>
</table>

2. Has a single individual been designated as Program Administrator for the respirator protection program?  
   
   Comments:  
   
<table>
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<tr>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
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</thead>
</table>

3. Does the Program Administrator have sufficient knowledge of respiratory protection?  
   
   Comments:  
   
<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
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</thead>
</table>

### 2. Respirator Selection

1. Are there written standard operating procedures (SOPs) governing the selection and use of respirators?  
   
   Comments:  
   
<table>
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<tr>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
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2. Are written worksite-specific procedures used to specify the type of respirator used for work tasks and emergencies?  
   
   Comments:  
   
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<tr>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
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3. Are only NIOSH approved respirators authorized for use?  
   
   Comments:  
   
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<th>Yes</th>
<th>No</th>
<th>N/A</th>
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### 3. Medical Evaluation

1. Does each respirator user receive a medical evaluation to determine the user’s physical and psychological ability to wear a respirator?  
   
   Comments:  
   
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<th>Yes</th>
<th>No</th>
<th>N/A</th>
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2. Is the PLHCP provided with supplemental information concerning the frequency and duration of respirator use and conditions of use in the work environment?  
   
   Comments:  
   
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<th>Yes</th>
<th>No</th>
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### 4. Fit Testing

1. Are fit tests performed by qualified persons on an annual basis?  
   
   Comments:  
   
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<tr>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
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2. Are fit tests performed on all tight-fitting facepieces according to established fit test protocols?  
   
   Comments:  
   
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<th>Yes</th>
<th>No</th>
<th>N/A</th>
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3. Are a sufficient number of respirator models and sizes available to correctly fit respirator wearers?  
   
   Comments:  
   
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<th>Yes</th>
<th>No</th>
<th>N/A</th>
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4. 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?  
   
   Comments:  
   
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<th>Yes</th>
<th>No</th>
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5. Is a policy in place concerning facial hair and the use of respirators?

Comments: ____________________________

Yes ☐ No ☐ N/A ☐

5. **Maintenance, Care and Use**

1. Are respirators regularly cleaned and disinfected according to established procedures?

Comments: ____________________________

Yes ☐ No ☐ N/A ☐

2. Are respirators properly stored when not in use and are adequate storage facilities available to prevent respirator contamination?

Comments: ____________________________

Yes ☐ No ☐ N/A ☐

3. Are emergency use respirators stored in compartments clearly marked as containing emergency use respirators?

Comments: ____________________________

Yes ☐ No ☐ N/A ☐

4. Are respirators regularly inspected according to established procedures?

Comments: ____________________________

Yes ☐ No ☐ N/A ☐

5. Is there a program in place to inspect emergency use respirators on a monthly basis?

Comments: ____________________________

Yes ☐ No ☐ N/A ☐

6. 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?

Comments: ____________________________

Yes ☐ No ☐ N/A ☐

6. **Air Quality**

1. Are breathing air supply stations inspected on a semi-annual basis and are they installed and maintained in accordance with established engineering specifications?

Comments: ____________________________

Yes ☐ No ☐ N/A ☐

2. 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?

Comments: ____________________________

Yes ☐ No ☐ N/A ☐

3. 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?

Comments: ____________________________

Yes ☐ No ☐ N/A ☐

7. **Training**

1. Are employees who wear respirators trained before initial respirator use and at least annually thereafter?

Comments: ____________________________

Yes ☐ No ☐ N/A ☐
2. Does the training program include the following elements:
   - The proper use, limitations and capabilities of the respirator.
   - Proper use in emergencies.
   - Information on inspection, how to put on and remove the respirator, seal checks, maintenance and storage.
   - How to recognize symptoms that impact respirator use.
   - General requirements of MIOSHA Part 451 / OSHA 1910.134.

Comments:______________________________________________________________

3. Are employees provided additional hands-on instruction for proper respirator use in conjunction with fit-testing sessions?

Comments:______________________________________________________________

8. Program Evaluation

1. Are periodic evaluations of the respirator program conducted including a formal evaluation that is conducted at least annually?

Comments:______________________________________________________________

2. Are employees who use respirators regularly consulted in order to determine respirator program effectiveness?

Comments:______________________________________________________________

9. Recordkeeping

1. Are records available to show that employees who use respirators have been trained?

Comments:______________________________________________________________

2. Are records available to show that respirator users have been medically evaluated to determine their ability to wear respirators?

Comments:______________________________________________________________

3. 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:______________________________________________________________

4. Are records available to show that emergency use respirators are inspected monthly?

Comments:______________________________________________________________

5. Are records available showing a certificate of analysis for purchased breathing air cylinders?

Comments:______________________________________________________________

6. Are records available documenting the replacement of filters for the breathing air supply system?

Comments:______________________________________________________________

7. Are records available to document that the respirator program is being evaluated to determine the program’s effectiveness?

Comments:______________________________________________________________

Assessment Completed By: ____________________________________________

Date Completed: ________________________________________________________
Appendix L

RESPIRATOR USER SURVEY FORM

Name (optional): _____  UM ID (optional): _____
Dept. Name: _____  Date: _____
Job Title: _____

You have been identified as a current user of respiratory protection at the University of Michigan (UM) and selected to participate in our annual User Survey. This survey contains a few questions about your use of respirator(s) at UM and only takes a couple of minutes to complete. The purpose of this survey is to help OSEH evaluate the effectiveness of our respirator program and assist us in making any improvements or other changes to the program. Please take some of your time and respond to all questions, as appropriate, and return the completed Form to OSEH.

Thank you for completing this survey & helping us improve our program!

If you answer “No” to any of the following questions, please provide comments and indicate the model and type of respirator and/or cartridge you are referring to.

1. For respirators with tight-fitting facepieces, e.g., a full or ½-face APR or SCBA: Does the respirator you wear fit properly and maintain a good seal with your face?
   Yes ☐  No* ☐  N/A ☐
   Improvement Suggestions / Comments: (* Please provide the respirator model/type, 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* ☐  N/A ☐
   Improvement Suggestions / Comments: (* Please provide the respirator model/type, if you answered no.)

3. Is the respirator you wear appropriate for the hazards of your job, i.e., does it provide you with adequate respiratory protection?
   Yes ☐  No* ☐  N/A ☐
   Improvement Suggestions / Comments: (* Please provide the respirator model/type, if you answered no.)
4. Is the respirator you wear maintained in good condition, i.e., is it stored properly, cleaned properly and repaired promptly when necessary?

   Yes ☐ No* ☐ N/A ☐

Improvement Suggestions / Comments: (* Please provide the respirator model/type, 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* ☐ N/A ☐
   B. Perform a User Seal Check before each use? Yes ☐ No* ☐ N/A ☐

Improvement Suggestions / Comments: (* Please provide the respirator model/type, if you answered no.)

6. Do you smell chemical odors while wearing a cartridge respirator?

   Select the response that best describes your answer.
   
   Almost Always ☐ Sometimes ☐ Never ☐
   1* ☐ 2* ☐ 3 ☐ 4 ☐ 5 ☐

Improvement Suggestions / Comments: (* Please provide the respirator & cartridge type, if you noted 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?

   Select the response that best describes your answer.
   
   Not Satisfied ☐ Satisfied ☐ Very Satisfied ☐
   1* ☐ 2* ☐ 3 ☐ 4 ☐ 5 ☐

Improvement Suggestions / Comments: (* Please provide the respirator type, if you noted category 1 or 2.)