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RESPIRATORY PROTECTION PROGRAM

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Foreword

It is the intention of Rensselaer Polytechnic Institute to provide a safe, healthful environment for all work activities, research and learning. This program is designed to provide information and requirements regarding respiratory protection to achieve that goal. The use of respiratory protection at Rensselaer is largely directed by the requirements contained in OSHA regulations, specifically **29 CFR 1910.134.** A component of this regulation is the concept of achieving exposure control through the determination and implementation of engineering controls whenever feasible. When such controls are not feasible to achieve adequate exposure control, personal protective equipment and/or other protective measures must be used. A respirator is any device intended to protect the user from airborne contaminants and/or oxygen deficient environments. The selection and proper usage of respiratory protection is a critical component of the desired result of exposure control. Significant amounts of information must be known about the contaminants, and the environment in which respirators will be utilized to provide adequate protection. Some of this information includes:

1. General use conditions, including determination of contaminant(s);
2. Physical, chemical, and toxicological properties of the contaminant(s);
3. Odor threshold data;
4. The smallest of the Permissible Exposure Limit (PEL), Recommended Exposure Limit (REL) and Threshold Limit Value (TLV) exposure limits
5. **Immediately dangerous to life or health (IDLH) concentration; No Rensselaer employee should ever enter an atmosphere that is known to be IDLH (Immediately Dangerous to Life and Health). If an atmosphere becomes IDLH after entrance, it must be evacuated immediately and not re-entered until the IDLH atmosphere is no longer present.**
6. Eye and skin irritation potential; and
7. Any service life information available (for cartridges and canisters).

All Rensselaer employees who wear a respirator, either due to institute policy or by personal choice (see Non-Mandatory use section), must due so in accordance with this program and must inform the ***Office of Environmental Health and Safety*** of their activities.

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Definitions

Air-purifying respirator: means a respirator with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element.
Assigned protection factor (APF): of a respirator reflects the level of protection that a properly functioning respirator would be expected to provide to a population of properly fitted and trained users.
Atmosphere-supplying respirator: means a respirator that supplies the respirator 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.
Canister or cartridge: means a container with a filter, sorbent, or catalyst, or combination of these items, which removes specific contaminants from the air passed through the container.
Demand respirator: means an atmosphere-supplying respirator that admits breathing air to the face piece only when a negative pressure is created inside the face piece by inhalation.
Emergency situation: means any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment that may or does result in an uncontrolled significant release of an airborne contaminant.
Employee exposure: means exposure to a concentration of an airborne contaminant that would occur if the employee were not using respiratory protection.
End-of-service-life indicator (ESLI): means a system that warns the respirator user of the approach of the end of adequate respiratory protection, for example, that the sorbent is approaching saturation or is no longer effective.
Escape-only respirator: means a respirator intended to be used only for emergency exit.
Filter or air purifying element: means a component used in respirators to remove solid or liquid aerosols from the inspired air.
Filtering face piece (dust mask): means a negative pressure particulate respirator with a filter as an integral part of the face piece or with the entire face piece composed of the filtering medium.
Fit factor: means a quantitative estimate of the fit of a particular respirator to a specific individual, and typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn.
Fit test: 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.)
Helmet: means a rigid respiratory inlet covering that also provides head protection against impact and penetration.

High efficiency particulate air (HEPA) filter: means a filter that is at least 99.97% efficient in removing monodisperse particles of 0.3 micrometers in diameter. The equivalent NIOSH 42 CFR 84 particulate filters are the N100, R100, and P100 filters.
Hood: means a respiratory inlet covering that completely covers the head and neck and may also cover portions of the shoulders and torso.
Immediately dangerous to life or health (IDLH): means 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.
Loose-fitting face piece: means a respiratory inlet covering that is designed to form a partial seal with the face.
Maximum use concentration (MUC): the maximum concentration, not to exceed the IDLH concentration, of a specific contaminant in which a respirator can be worn. The MUC is calculated by multiplying the Protection Factor (PF) by the lowest of the PEL/TLV/REL
Negative pressure respirator (tight fitting): means a respirator in which the air pressure inside the face piece is negative during inhalation with respect to the ambient air pressure outside the respirator.
Oxygen deficient atmosphere: means an atmosphere with an oxygen content below 19.5% by volume.
Physician or other licensed health care professional (PLHCP): means an individual whose legally permitted scope of practice (i.e., license, registration, or certification) allows him or her to independently provide, or be delegated the responsibility to provide, some or all of the health care services required by paragraph (e) of this section.
Positive pressure respirator: means a respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.
Powered air-purifying respirator (PAPR): means an air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.
Pressure demand respirator means a positive pressure atmosphere-supplying respirator that admits breathing air to the face piece when the positive pressure is reduced inside the face piece by inhalation.
Qualitative fit test (QLFT): means a pass/fail fit test to assess the adequacy of respirator fit that relies on the individual's response to the 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.
Respiratory inlet covering: means that portion of a respirator that forms the protective barrier between the user's respiratory tract and an air-purifying device or breathing air source, or both. It may be a face piece, helmet, hood, suit, or a mouthpiece respirator with nose clamp.
Self-contained breathing apparatus (SCBA): means an atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user.

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

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

Tight-fitting face piece: means a respiratory inlet covering that forms a complete seal with the face.

User seal check: means an action conducted by the respirator user to determine if the respirator is properly seated to the face.

Non-Mandatory (Voluntary) Use: when an employee chooses to wear a respirator, even though the use of a respirator is not required by either Rensselaer or by any OSHA standard.

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Section 1. Responsibilities

1,1 Program Administrator

The primary function of Rensselaer's Respiratory Protection Program Administrator involves administering the program and evaluating its effectiveness. An individual is qualified to be a program administrator if he or she has appropriate training or experience in accord with the program's level of complexity. The administrator may rely on other employees to help run parts of the respiratory protection program (e.g., fit testing, medical evaluations). The Program Administrator is responsible for assuring that all of the requirements of this program are applied to the Rensselaer workplace. The current Program administrator for Rensselaer's Respiratory Protection Program is:

Will Fahey
Training and Program Development Specialist
Office of Environmental Health and Safety
Phone: 518-276-2318
E-mail Address: faheyw@rpi.edu

1.2 Employees/Supervisors

It is the dual responsibility of each employee and his/her supervisor to be familiar with, and strictly adhere to the contents and requirements of this program. No employee shall engage in the utilization of respiratory protection (with the exception of Filtering Face Pieces –see section 3.3) without the written approval of the *Program Administrator*. Individuals that believe that respiratory protection is necessary, or desired, should contact the *Program Administrator* prior to utilizing respiratory protection.

1.3 Non-Mandatory (Voluntary) Respirator Users

Non-Mandatory (Voluntary) use is defined as a situation in which an employee chooses to wear a respirator, even though the use of a respirator is not required by either Rensselaer or by any OSHA standard. Voluntary use **does not** exempt an employee from the notification requirements included in section 1.2. Further, Voluntary Respirator Users must follow the following procedures:

- The voluntary user must notify the Program Administrator of the intended voluntary respirator use prior to the utilization of the respiratory protection.

- The Program Administrator must determine that the respirator itself will not present a hazard to the employee due to misuse, other hazards or conditions in the workplace, or employee medical conditions.

- The Voluntary User must be provided with, sign, and date the advisory information included in **Appendix C** prior to the utilization of the respiratory protection by the voluntary user

- The Voluntary User must complete a medical evaluation and on-going evaluations as described in section 4 of this program prior to the utilization of the respiratory protection by the voluntary user

- The Voluntary User must be appropriately fit tested for the type and style of respirator to be used. This procedure must satisfy the requirements presented in section 5 of this program.

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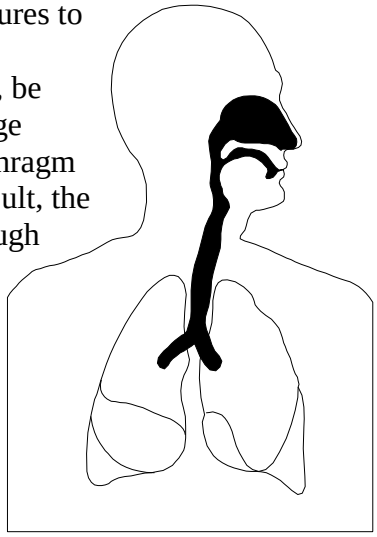
Section 2.0 Respiratory Hazards

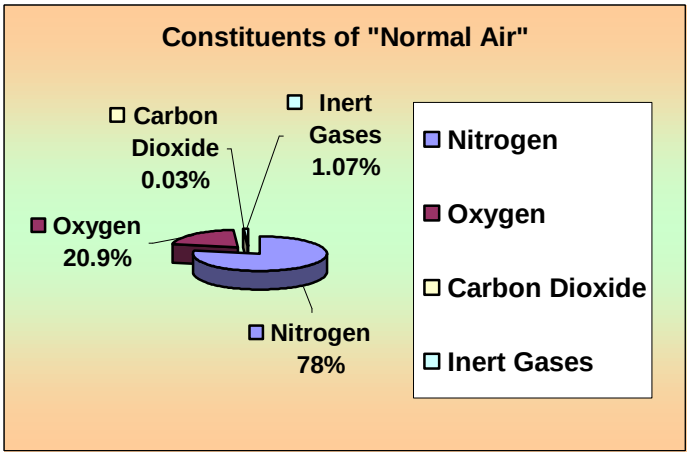
2.1 **Introduction to Respiratory Protection**



To a limited degree, the respiratory system is able to tolerate exposures to gases, vapors and particulates. In excessive amounts, however, contaminants can impair or destroy portions of the respiratory tract, be absorbed directly into the bloodstream from the lungs and/or damage organs and tissues. When air is inhaled, the chest muscles and diaphragm contract, lifting the rib cage and enlarging the chest cavity. As a result, the lungs expand and fill with air. Contaminants may be absorbed through nasal passages and linings of the respiratory tract or may continue through the trachea (windpipe) and into the lungs. In the lungs oxygen enriched blood is exchanged for carbon dioxide, which is diffused out to be exhaled. This blood has the potential to distribute contaminants throughout the body. Respirators, when properly fitting and of the appropriate design, have the capability of drastically reducing the amount of contaminants entering the respiratory system.

2.2 **Oxygen Deficiency**

"Normal Air" consists of 78% Nitrogen, 20.9% Oxygen, .03 % Carbon Dioxide and 1.07 % inert gases.



Atmospheres containing less than 19.5% oxygen are considered to be **oxygen deficient**. One or both of the following factors generally cause oxygen deficiency:

1. Displacement: Oxygen is displaced by another material. (chemical)
2. Consumption: Oxygen is consumed in some type of process. (rusting)

Regardless of the cause of the oxygen deficiency, if ventilation is not possible and/or effective in normalizing the oxygen concentration in the atmosphere (meaning that the oxygen concentration in the space remains less than 19.5%) the atmosphere is considered to be both oxygen deficient and IDLH and entry into the environment may not occur. Atmospheres containing oxygen concentrations greater than 23.5% also present hazards and should not be entered. The Rensselaer *Confined Space Entry Program* may be referenced for specific information regarding entry into hazardous atmospheres.

2.3 **Chemical Contaminants**

As previously discussed, chemical contaminants in the air can create a host of health related concerns depending upon the dose, specific chemical and other factors. Identifying potential chemical hazards, as well as potential concentrations is critical. This information allows for the appropriate selection of respiratory protection. In certain areas chemical monitoring may be required to determine exposure levels. For purposes of respiratory protection, chemicals can be grouped into the following broad categories:

- Irritants: corrosive substances which injure and inflame tissue
- Asphyxiant: substances which displace oxygen or chemically prevent the use of oxygen in he body
- Anesthetics: substances which depress the central nervous system, causing a loss of sensation or intoxication
- Systemic poisons: substances, which can cause disease in various organ systems.

2.4 **Aerosols**

The term "aerosol" is used to describe fine particulates (solid or liquid) that are suspended in air. Aerosols are capable of created serious health hazards depending upon their composition and concentration. Aerosols may be filtered by using an appropriately designed mechanical filtering device.

2.5 **Dusts, Smoke and Particles**

Dusts and smoke are produced by a mixture of particulate in air. As with aerosols, the diameter of the particulate is to a large degree the determining factor in choosing appropriate respiratory protection. Smoke is generally liquid or solid particles created by the incomplete combustion of a material. Certain dusts can create explosive environments when present in appropriate concentrations.

Section 3. Selection of Respirators

The selection of respiratory protection is a process that involves the evaluation and understanding of the work environment and potential hazards. The following items must be considered, at a minimum, in the selection/evaluation of respiratory protection:

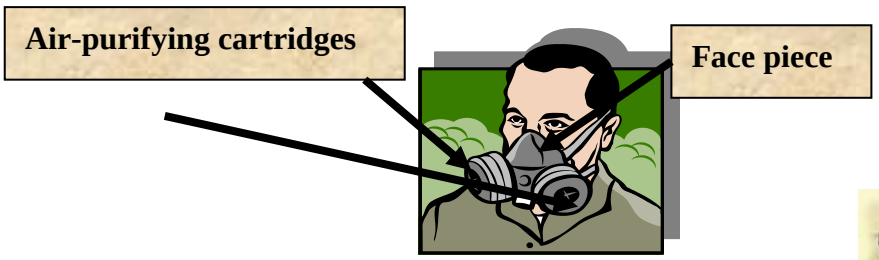
- Effectiveness of the device against the substance(s) of concern
- Estimated maximum concentration of the substance in the work area
- General environment (confined space, open area etc.)
- Known limitations of each type of respiratory device
- Potential for oxygen deficiency
- Odor threshold data
- Eye irritation potential
- Physical, chemical and toxicological properties of the contaminant(s)
- Immediately dangerous to life and health (IDLH) concentration
- Any available service life information (for cartridges and canisters)

3.1 **Air Purifying Respirators (APR)**

Air Purifying Respirators (APR's) function by passing atmospheric air through an purifying element. APR's generally fall into one of three categories:

- Particulate APR's which employ a mechanical filter element
- Gas/Vapor APR's that utilize chemical sorbents contained in cartridges or canisters
- Combination Particulate/Gas-Vapor respirators

APR's contain two major components: The face piece and the air-purifying element.



APR's also are available in both:

- Full-Face
- Half-mask styles

The face piece seals the respirator to the wearer. Attached to the face piece is the lens (in the case of a Full Face respirator) and suspension straps for holding the mask to the face. Contained within Air-purifying respirators are check valves and exhalation valves which prevent exhaled breath from entering the respirator through a valve other than through the cartridge(s). It is important to note that each respirator manufacturer has unique ways of assembling respirator components and unique parts. Always use replacement parts that are of the same manufacturer and part number as the respirator.

APR's have several limitations, which are important to understand. First, APR's, by design, filter ambient air. **APR's are ineffective in oxygen deficient atmospheres**. Secondly, APR's filter only those contaminants that they have been equipped to filter. That is, specific cartridges must be used with an APR designed to filter specific contaminants. APR's also are designed with Maximum Use Concentrations (MUC) (the maximum concentration at which an APR can be utilized).
The **Maximum Use Concentration** is defined as:

MUC = PF x Lowest of the (TLV or PEL or REL) values where

MUC = Maximum Use Concentration
PF = Protection Factor CO/CI (See section 4)
TLV = Threshold Limit Value
PEL = Permissible Exposure Limit
REL = Recommended Exposure Limit
} Lowest of the three values

Example: If an individual was considering respiratory exposure to Benzene, the following exposure limits would apply:

TLV: .5 PPM
REL: .1 PPM
PEL: 1 PPM
Thus utilizing the formula:

MUC = PF (If qualitative fit testing use Assigned Protection Factors in Appendix A)
10(Half Mask) or 50(Full Face piece) x .1 PPM (REL)
MUC = **1 PPM (Half Mask) 5 PPM (Full Face piece)** (IDLH = 500 PPM)

If exposure concentrations are expected to exceed 5 PPM, or if the environment was potentially oxygen deficient, an APR could not be utilized in this example.

These factors necessitate that the user know both the hazardous constituent(s) present in an environment and the concentration of those constituent(s).

Air Purifying Respirators may be utilized only if all of the following conditions are met:

1. **The identity and concentration of the contaminant(s) are known**
2. **The oxygen content of the environment is greater than or equal to 19.5%**
3. **There is periodic monitoring of the work area if required**
4. **The chemical has adequate warning properties.**
5. **The respirator assembly is approved for protection against the specific contaminant and concentration level.**
6. **The type of respirator being used has been successfully fit tested on the wearer.**
7. **The Maximum Use Concentration (MUC) of the respirator and cartridge will not be exceeded.**

3.1(a) **Powered Air Purifying Respirators (PAPR)**

Powered Air Purifying Respirators (PAPR) are a type of air-purifying respirator that uses a mechanical device instead of lung-power to force air through the cartridge/canister and into the face piece. Due to the fact that the delivered air creates no resistance, PAPR's should maintain a ***positive pressure*** at all times. (See Section 5)

PAPR's, although mechanically enhanced, filter ambient air. As such, like all APR's **PAPR's are ineffective in oxygen deficient atmospheres.**

3.1(b) **Identification/Selection of Respirator Cartridges/Canisters**

Respiratory hazards can generally be divided into two categories: particulates and vapors/gases. Particulates are filtered by mechanical means, while vapors are removed by sorbents that are chemically reactive. Respirators using a combination of a mechanical filter and chemical sorbent will effectively remove both hazards.

Particulate Removing Filters

Particulates can occur as dusts, fumes, or mists. The hazards posed by particulates/gas-vapors can be referenced according to the material's Permissible Exposure Limit (PEL), recommended Exposure Limit (REL) and/or Threshold Limit Value (TLV).

- **PEL - Permissible Exposure Limit** is the limit that OSHA (legal limit) has set for employee exposure to regulated contaminants that a worker may be exposed to in a typical 40 hour work week (8 hours/day, based on a time weighted average)

A complete list of OSHA PEL values is available at:
http://www.osha-slc.gov/SLTC/respiratory_advisor/advisor_genius_nrdl/z_tables.html

- **TLV - Threshold Limit Value**. The time weighted average concentration for a conventional 8-hour workday and 40-hour workweek, to which scientific data indicates that nearly all workers may be repeatedly exposed, day after day, without adverse effect. TLVs are published annually by the ACGIH (American Conference of Governmental Industrial Hygienists) and are guidance values.

- **REL- Recommended Exposure Limit:** The time weighted average concentration for up to a 10-hour workday during a 40-hour work week as published by the National Institute for Occupational Safety and Health (NIOSH). Like TLVs, RELs are guidance values. A complete list of REL values is available at: *http://www.cdc.gov/niosh/npg/npgd0000.html*

Particulate-removing cartridges contain a filter that reduces the inhaled concentration of toxic dusts and fiber, such as lead, asbestos, fumes, mists, and radioactive and biological materials. Due to the design of the cartridges, their efficiency actually increases with use as the trapped particulate acts to reduce the filter media screen size. However when breathing becomes strained, the cartridges should be replaced. Particulate removing cartridges/filters are categorized into nine classes based on filter efficiency and resistance to oil.

•3 levels of filter efficiency*:*
–95% (called "95")
–99% (called "99")
–99.97% (called "100")

•3 categories of resistance to filter efficiency degradation:
–N (*N*ot resistant to oil)
–R (*R*esistant to oil)
–P (oil *P*roof)

If no oil particles are present, use any series (N, R, or P); If oil particles are present, use *only* R or P series; If oil particles are present and the filter is to be used for more than one work shift, use *only* P series.

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Gas and Vapor Removing Cartridges

Respirators using Air Purifying Respirator cartridges are designed to protect the wearer from specific chemical hazards. Manufacturers are required to color code cartridges in a uniform manner in an attempt to standardize the selection process. Some of the uniform color codes are:

- **Black** -- organic vapors
- **White** -- acid gas
- **Green** -- ammonia gas/methylamine
- **Magenta**- Particulate aerosols
- **Yellow** -- mixture of acid gases and organic vapors
- **Orange**—mercury and chlorine

All gas and vapor removing cartridges have limitations. It is important to identify the maximum concentration of contaminant(s) for which the cartridge or canister is approved.

3.1(c) **Service Life of Respirator Cartridges/Canisters**

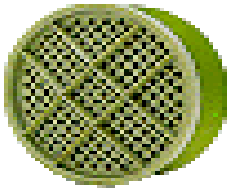
Each cartridge or canister has a finite capacity for removing contaminants. Once the included sorbent has reached a point of saturation the "cleaning" element will allow contaminants to pass through and enter the face piece. To insure that chemical cartridges are replaced before the service life ends, cartridges equipped with End-of-Service-Life Indicators (ESLI**)** should be used whenever possible**.** When ESLI technology does not exist or is not possible for a given contaminant**,** a cartridge change-out schedule must be developed and followed. EH&S staff are available to assist departments in complying with this regulatory requirement. In all cases the cartridge/canister manufacturer should be contacted and/or referenced to determine specific service life and change out frequency recommendations.

Listed below are OSHA-recognized rules of thumb that can be used to estimate chemical cartridge service life:

- If the chemical's boiling point is >70C (158F) and the concentration is less than 200 ppm you can expect a service life of 8 hours at a normal work rate
- Reducing concentration by a factor of ten (10) will increase the service life by a factor of five (5)
- Humidity above 85% will reduce service life by 50%.

The following factors should also be considered when determining service life.

- The contaminant(s) that the respirator is to protect against
- The concentration of contaminants in the work area
- Frequency of use
- Work Rates
- The presence of potentially interfering chemicals



3.2 **Supplied Air Respirators (SAR)**

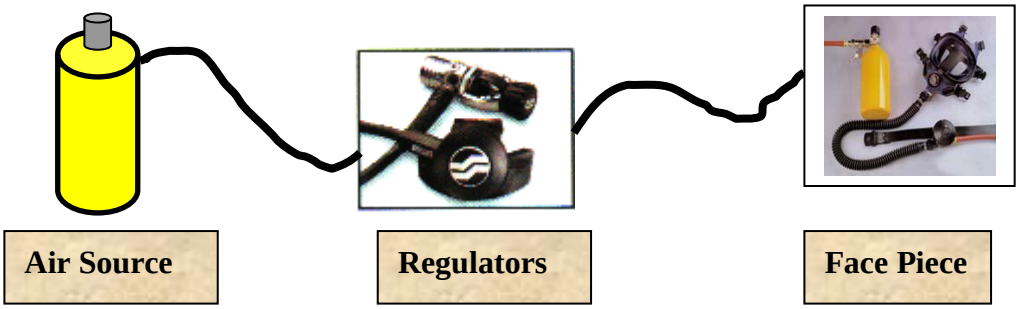
Supplied Air Respirators (SAR's) are used to provide breathing air from a source independent of the ambient atmosphere. There are two types of SAR's:

1. "Airline Respirators"
2. Self Contained breathing apparatus (SCBA)

SAR's will be used when:

- The concentration and/or constituent(s) of a contaminant in an atmosphere are unknown- Known, or potential IDLH atmospheres including oxygen deficient atmospheres **will not be entered**
- The contaminant(s) have inadequate warning properties
- Any of the requirements necessary for APR usage are not met
- The cartridge/canister limitations are exceeded or MUC is exceeded
- Exposure to any of the OSHA listed carcinogens, found at http://www.osha-slc.gov/OshStd_data/1910_1003.html is possible. (observe the requirements in all applicable paragraphs and appendices since they each have unique respiratory protection requirements)

Compressed air is the only type of breathing air system that is approved for use at Rensselaer. Compressed air is provided either from compressed gas cylinders or air compressors at relatively high pressures. Approval must be obtained from the ***Office of Environmental Health and Safety*** prior to the use of any air compressor system intended to provide breathing air. Regulators are used to reduce the pressures delivered to the face piece to a safe level.



Air Source

Breathing air, at a minimum, must meet the following composition requirements:

- Oxygen content must be at least 19.5% but no more than 23.5% of the total volume of air
- Condensed hydrocarbon content must be 5 milligrams/cubic meter of air or less
- Carbon monoxide level in breathing air must be 10 parts per million (ppm) or less
- Carbon dioxide level in breathing air must be 100 parts per million (ppm) or less
- The breathing air must not contain a noticeable odor

Cylinders of breathing air must be tested and maintained according to Department of Transportation (DOT) regulations Parts 173 and 178. The frequency and types of testing required is contained in **Section 7.3**. Cylinders of breathing air that are purchased from commercial vendors must include certification paperwork stating that the compressed air meets the minimum criteria listed above, also known as Grade D breathing air. Also, verification should be completed with manufacturers of commercially supplied breathing air that the product does not exceed a dew point of 50 F at 1 atmosphere of pressure. This verification is intended to prevent regulator freeze up due to excessive moisture content. Appropriate identifying labels must be on all cylinders at all times.

Regulators

Regulators reduce the pressure of supplied breathing air to levels safe for use. The use of improper or faulty regulators can lead to serious injury and even death. It is critical that only regulators designed for breathing air be used in supplied air systems. **Never use an Oxygen regulator in a supplied air system** as quantities of oil and grease in the system can lead to fire and explosion hazards.

SAR's, which operate on the airline system, must include no more than 300 feet of airline. The air source must not be depletable (escape bottle).

3.2(a) **Demand Respirators**

When an SAR is in the demand mode, the inhalation of the wearer creates a negative pressure inside the face-piece and breathing tubes. The pressure gradient opens an admission valve and allows air to enter the face-piece and then be inhaled. It is possible, however, in the demand mode of an SAR, to inhale contaminants through any gaps that may be present in the face to face-piece seal.

3.2(b) **Pressure Demand Respirators**

When an SAR is in the pressure demand mode, a positive pressure is maintained at all times inside the face-piece. If any leakage occurs, it is outward from the face piece.

3.2(c) **Continuous-Flow Respirators**

In addition to demand and pressure demand modes, airline respirators are available in continuous flow configurations. Continuous flow airline respirators maintain airflow at all times, rather than only on demand. In place of a demand or pressure demand regulator, an airflow control valve or orifice partially controls airflow. A flow of at least 115 LPM

(tight fitting face piece) or 170 LPM (loose fitting hood or helmet) must be maintained at the lowest air pressure and longest hose length specified. By design, either the control valve cannot be closed completely, or a continually open bypass is provided to allow air to flow around the valve and maintain the required minimum rates.

3.2(d) **Self Contained Breathing Apparatus (SCBA)**

There are two types of Self Contained Breathing Apparatus:

- *Closed Circuit*: Commonly referred to as a "re-breather", the device recycles exhaled breath. The air for breathing is mixed in a flexible breathing bag and allows the unit to require only a small oxygen supply.

- *Open Circuit:* An open circuit SCBA exhausts the exhaled air to the atmosphere and does not re-circulate it. The air source regulator and face-piece are all included in a portable unit.

All SCBA devices must be equipped with low pressure alarming devices, which alert the user to low air pressure. The alarm should be capable of alerting the user to 25% or less remaining breathable air. As with other respiratory equipment, periodic inspection is required. The details of SCBA inspection frequency requirements are outlined in **Section 7.3.**

3.3 **Filtering Face Pieces**

Filtering Face Pieces and dust masks can provide protection from dusts, mists and certain other fibers. Only Filtering Face pieces approved by the National Institute for Occupational Safety and Health (NIOSH) may be utilized at Rensselaer. **Filtering Face pieces provide no protection from chemical contaminants and cannot be used in oxygen deficient atmospheres.** Filtering Face pieces must be maintained in a clean and functional manor. Damaged or soiled Filtering Face pieces must be discarded. Filtering Face pieces that are approved by NIOSH, may be used at Rensselaer on a non-mandatory basis without completing the medical requirements outlined in Section 4. Voluntary users of filtering face pieces must, however, notify the Respiratory Program Administrator of their intended use prior to introducing them into the workplace, and complete the information included in Appendix C of this program.

3.4 **Respirator Selection Logic**

The proper selection of a respirator is critical to exposure prevention. When selecting a respirator, the following ten points should be used as minimum selection criteria:

- What is/are the *potential* contaminant(s) and at what concentration(s) will it be present?
- What is the PEL/TLV/REL (Lowest of the three values) for the given contaminant(s)?
- Is the contaminant a gas, vapor, mist, dust or fume?
- Could the contaminant concentration be termed immediately dangerous to life or health (IDLH)?
- If the contaminant is flammable, does the estimated concentration approach the Lower Explosive Limit (LEL)?
- Does the contaminant have adequate warning properties?
- Will the contaminant irritate the eyes at the estimated concentration?
- If the contaminant is a gas or vapor, is there an available cartridge/canister that will effectively filter it.
- Can the contaminant be absorbed through the skin as a vapor or liquid? If so, will it cause injury?
- What is the nature of the work to be performed?

The following page contains a flowchart designed to aid in respirator selection.

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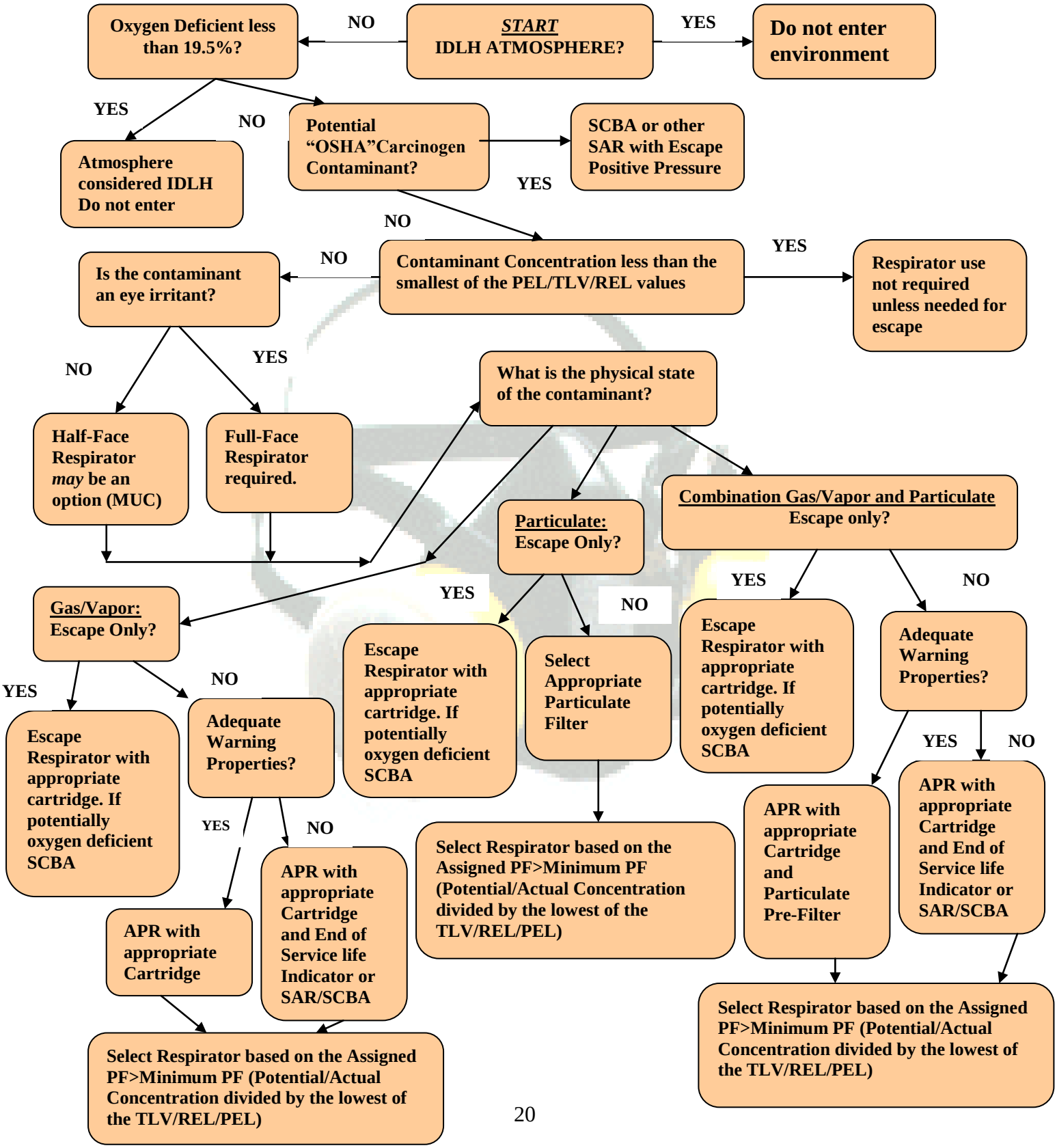
Respiratory Protection Selection Criteria Guide



Section 4. Medical Evaluation

4.1 **Initial (Pre-usage)**

Due to the potential health related effects of respirator usage, all employees that may need to utilize respiratory protection at Rensselaer are required to receive a pre-usage medical evaluation prior to being "Fit Tested" (See Section 5) or utilizing a respirator at Rensselaer. (Pre-Usage medical evaluations are **not** required when **Filtering Face Pieces** are used on a voluntary basis.)

Specific medical conditions that may place an employee at increased risk of illness, injury or death include, but are not limited to:

- Cardiovascular and respiratory disease, such as high blood pressure, angina, asthma, chronic bronchitis or emphysema
- Cardiovascular damage caused by heart attack or stroke
- Reduced lung function caused by prior factors such as smoking or prior exposure to respiratory hazards
- Neurological disorders such as epilepsy
- Musculoskeletal disorders such as lower back pain
- Psychological conditions such as claustrophobia and severe anxiety

Rensselaer will provide initial medical evaluations at no cost to the employee and at a time and place that is convenient to the employee. A Physician or other Licensed Health Care Professional (PLHCP) will review the initial medical evaluation and will utilize the questionnaire, or obtain the same information that is included in the questionnaire that is presented in Appendix C to OSHA regulation 29 CFR 1910.134. The contents of this questionnaire are available from the ***Office Of Environmental Health and Safety*** or may be viewed on the web at:

http://www.osha-slc.gov/Preamble/RP_html/RESPIRATORY9.html

The medical evaluation and fit-testing portions of Rensselaer's *Respiratory Protection Program* are currently being administered by:

Occupational Health Services/Capital Health
2001 5th Avenue
Troy N.Y. 12180

The results of all medical evaluations will be kept confidential. The PLHCP will be made available to Rensselaer employees to discuss the contents of their medial evaluations. Rensselaer will provide the PLHCP with information specific to each employee's potential respiratory protection requirement. This information will include:

- The type and weight of the respirator to be worn by the employee
- The estimated duration and frequency of respirator use
- The tasks the employee may be completing while wearing the respirator
- Additional Personal Protective Equipment that the employee may be required to wear
- The temperature and humidity extremes that may be encountered in the work area

The form included in **Appendix E** should be used to document this information. The form, once completed and signed by the PLHCP must be returned to the **Program Administrator**.

Based on the combination of information provided by Rensselaer, the contents of the medical questionnaire and any other factors in which the PLHCP deems as relevant to the medical evaluation, the PLHCP will furnish both Rensselaer and each employee a written determination regarding the employee's medical qualification to wear the respirator. This written determination will include:

- A determination of whether the employee is medically able to use a respirator
- Any limitations on the respirator use related to the medical condition of the employee or to the workplace conditions in which the respirator will be used.
- The need, if any, for follow up medical evaluations
- Verification that the PLHCP has provided a copy of the written determination to the employee

4.2 **Follow-Up Medical Evaluations**

Follow-up medical evaluations will be made available to Rensselaer employees whenever any of the following events occur:

1. The employee reports symptoms related to his/her ability to wear a respirator
2. The PLHCP, Respiratory Protection Program Administrator, or supervisor determines that a medical re-evaluation is necessary
3. Information from this program suggests a need for re-evaluation
4. Workplace conditions change as to place an increased burden on the employee's health

4.3 **Record Keeping**

All applicable medical evaluation records will be kept strictly confidential and will be made available to employees upon request.

Section 5. Fit Testing

Annual Fit Testing is a process that is designed to ensure that a specific type of respirator (Size, Brand, Style and Type) fits a specific individual adequately. If a respirator does not fit an individual appropriately contaminants may leak into the face-piece causing potential exposure. Fit Test procedures must be completed, at a minimum:

1. Prior to Initial use
2. Whenever an individual switches to a different type of respirator
3. When there is a significant physical change in the respirator wearer
4. **At least annually**

There are two types of Fit Tests: Qualitative and Quantitative. **Qualitative Fit Testing is not appropriate for all situations**. There are several concepts that are integral to proper respirator fit and selection:

Positive Pressure respirators maintain positive pressure inside the face piece throughout the user's breathing cycle. The air pressure inside the face piece exceeds the pressure outside of the face piece preventing contaminants from entering the face piece if leakage occurs.

Negative Pressure respirators, in contrast, do not afford such pressure protection. The air pressure outside of a negative pressure respirator exceeds the air pressure inside allowing contaminants to enter the face piece if leakage at the face-to-face piece seal occurs.

Fit Factor is a quantitative measure of how well a particular respirator fits an individual. It is defined as the ratio of the concentration of a contaminant in the environment to the concentration inside the mask. Fit Factors are obtained from ***Quantitative Fit Testing***.

$$FF = \frac{Concentration\ Outside\ the\ mask\ (CO)}{Concentration\ Inside\ the\ mask\ (CI)}$$

For example, if an employee was placed in a test chamber containing 300 ppm of a test agent and 3 ppm of the test agent was measured inside the face piece of the respirator, the Fit Factor/Protection Factor would equal 100.

The ***Assigned Protection Factor (APF)*** of a respirator reflects the level of protection that a properly functioning respirator would be expected to provide to a population of properly fitted and trained users. For example, an APF of 10 for a respirator means that a user could expect to inhale no more than one tenth of the airborne contaminant present.

5.1 **Qualitative**

Qualitative Fit Testing is a non-numeric pass/fail test that relies on the respirator wearer's response to a substance (test agent) used in the test to determine respirator fit. To complete the test the respirator wearer generally stands in an enclosure and is subjected to a test agent such as Isoamyl Acetate, Saccharin, Bitrex or irritant smoke. If the respirator wearer can smell any of the test agents, or is irritated by the smoke, the fit test is failed as an adequate face to face piece seal has not been established. In such cases (Qualitative Fit Test failures) another make, size or brand of respirator must be used until a sufficient seal has been established. Only OSHA-approved Qualitative Fit test protocols are acceptable at Rensselaer. These protocols can be obtained from the ***Office of Environmental Health and Safety*** and are available on the web at:

http://www.osha-slc.gov/OshStd_data/1915_1001_APP_C.html

As was previously stated **Qualitative Fit Testing is not appropriate for all situations.** Qualitative fit testing may not be used to fit negative pressure respirators, either air purifying or atmosphere supplying, when exposure to more than ten times the Permissible Exposure Limit is possible. (Fit factors in excess of 100 are required).

5.2 **Quantitative**

Quantitative Fit Testing involves the numeric measurement of leakage into a respirator. Sampling probes or other measuring devices are used to record this measurement. For a respirator to be considered as fitting properly (when considering the quantitative method), quantitative analysis must show:

- A Fit Factor equal to or greater than 100 for Half and quarter face pieces
- A Fit Factor equal to or greater than 500 for Full face pieces

As with qualitative fit testing, only OSHA-approved Quantitative Fit test protocols are acceptable at Rensselaer. These protocols can be obtained from the ***Office of Environmental Health and Safety*** and are available on the web at:

http://www.osha-slc.gov/OshStd_data/1915_1001_APP_C.html

5.3 **Acceptable Fit Test Methods**

The following chart summarizes the acceptable methods for fit testing respirators of varying types.

	Acceptable Fit-testing Methods	
Respirator	**QLFT**	**QNFT**
Half-Face, Negative Pressure, APR (<100 fit factor)	**Yes**	**Yes**
Full-Face, Negative Pressure, APR (<100 fit factor) used in atmospheres up to 10 times the PEL	**Yes**	**Yes**
Full-Face, Negative Pressure, APR (>100 fit factor)	**No**	**Yes**
PAPR	**Yes**	**Yes**
Supplied-Air Respirators (SAR), or SCBA used in Negative Pressure (Demand Mode) (>100 fit factor)	**No**	**Yes**
Supplied-Air Respirators (SAR), or SCBA used in Positive Pressure (Pressure Demand Mode)	**Yes**	**Yes**
SCBA - Structural Fire Fighting, Positive Pressure	**Yes**	**Yes**
SCBA/SAR - IDLH, Positive Pressure	**Yes**	**Yes**

5.4 **Record keeping**

Respirator fit testing of Rensselaer employees will be documented and will contain, at a minimum, the type of respirator utilized (brand, make and model), size of the respirator, method of testing and test results, test date, and the name of the individual administering the test. **Appendix D** contains Rensselaer's "*Fit Test Documentation Form***"**.

Section 6. Respirator Usage

6.1 **Preventing Leaks in the Face Piece Seal**

The proper seal of a tight fitting respirator to the face of the user is a critical element of exposure control. Additionally, the improper functioning of a respirator valve can result in exposure to contaminants. Specific conditions that can interfere with proper seals and valve functions can include:

- Facial hair
- Facial Scars
- Jewelry or headgear that projects under the face piece seal
- Corrective glasses, goggles or other personal protective equipment

6.2.**User Seal Checks**

To verify that leaks in the face piece seal are not present and that all respirator valves are working appropriately, "user seal checks" should be completed before each usage.

Note: User Seal Checks do not take the place of appropriate fit test procedures. User Seal Checks should be utilized for additional protection.

For the **Negative Pressure** check:

1. Cover the respirator inlets (Cartridges, Canisters or seals)
2. Gently Inhale
3. Hold the breath for ten (10) seconds

The face piece should "collapse" on your face and remain collapsed with no air leakage.

For the **Positive Pressure** check:

1. Cover the respirator's exhalation valves
2. Exhale

The respirator should hold the positive pressure for a few seconds. During this time no leakage should occur in the face-to-face piece seal.

If, at any point, during normal usage, an individual believes that their respirator is not properly functioning, he/she should immediately leave the area until further inspection can be completed on the respirator.

6.3 **Immediately Dangerous to Life and Health (IDLH) Atmospheres**

No Rensselaer employee should ever enter an atmosphere that is known to be IDLH (Immediately Dangerous to Life and Health). If an atmosphere becomes IDLH after entrance, it must be evacuated immediately and not re-entered until the IDLH atmosphere is no longer present.

Section 7. Respirator Maintenance

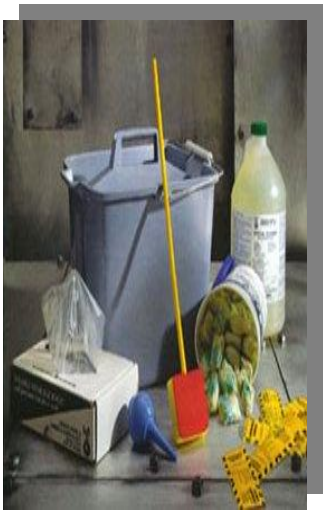
7.1 **Cleaning/Disinfecting**

Employees of Rensselaer who utilize respirator protection, and who are included within the scope of this program, are responsible for the cleaning/disinfecting of their own respirator(s). Since affected employees at Rensselaer are assigned personal respirators (respirators should not be shared between employees) the frequency of respirator cleaning/disinfecting must be such that the respirator(s) is maintained in a clean and sanitary fashion. The proper procedures for cleaning/disinfecting a respirator are:

1. Remove all cartridges, canister or filters. Disassemble face pieces by removing speaking diaphragms, demand and pressure-demand valve assembly's hoses, and all other components recommended by the respirator's manufacturer.
2. Wash the components in warm water with a mild detergent, preferably containing a disinfecting agent. (If the detergent does not contain a disinfecting agent, a solution can be made by adding approximately one milliliter of household bleach to one liter of water)
3. Rinse the components in clean, warm water. Be sure to rinse the components completely as failure to do so could result in skin irritation and the premature failure of respirator components.
4. Components should be hand dried with a clean, lint free cloth or air-dried.
5. Reassemble the respirator
6. Perform seal checks to verify that all components are returned to working order

Respirator cleaning/storage kits like the one pictured below are commercially available and include all of the necessary components to adequately clean and disinfect respiratory equipment.

7.2 **Storage**



Respirators must be stored in a manor that protects them from contamination, dust, sunlight extreme temperatures, extreme moisture damaging chemicals and other destructive forces at all times while not in use. Filter cartridges should be stored separately from cleaned respirators to prevent contamination of the interior of the face piece from hazardous particulate matter that may have accumulated on a filter cartridge. Also, respirators should be stored such that it retains it's original configuration. Synthetic materials and even rubber will warp if stored in an unnatural shape. thus affecting the fitting characteristics of the face piece. Storage bags, such as the example included in the picture on the right hand side of this page are recommended for cleaned respirator storage.

7.3 **Inspection**

To ensure that respiratory equipment remains in reliable, adequately functioning condition, inspections must be completed per the following schedules. Note: The table contains the ***minimum*** requirements.

Type of Respirator	Routine Use	Emergency Escape
APR	Must be inspected **before each use and during cleaning**. Inspection should include respirator function, tightness of connections condition of various parts such as the face piece, head straps, valves, connecting tube, and cartridges. Synthetic or rubber components must be evaluated for pliability and signs of deterioration.	Must be inspected **before entering the work area and during cleaning**. Inspection should include respirator function, tightness of connections condition of various parts such as the face piece, head straps, valves, connecting tube, and cartridges. Synthetic or rubber components must be evaluated for pliability and signs of deterioration.
SAR	Must be inspected **before each use and during cleaning**. Inspection should include respirator function, tightness of connections condition of various parts such as the face piece, head straps, valves, connecting tube, and cartridges. Synthetic or rubber components must be evaluated for pliability and signs of deterioration.	Must be inspected **before entering the work area and during cleaning**. Inspection should include respirator function, tightness of connections condition of various parts such as the face piece, head straps, valves, connecting tube, and cartridges. Synthetic or rubber components must be evaluated for pliability and signs of deterioration.
SCBA **Documentation Forms (Appendix B) must be forwarded to the Program Administrator on a monthly basis,**	**Must be inspected at least monthly.** Breathing air cylinders must be maintained in a fully charged state and recharged when the pressure falls below 90% of the manufacturer's recommended pressure level. The regulator, and all warning devices must be inspected to ensure proper function. Straps and other items must be inspected for signs of deterioration. Check hydrostatic test date on air bottle(s) Records of monthly inspections must be completed using the form included in **Appendix B**.	**Must be inspected at least monthly.** Breathing air cylinders must be maintained in a fully charged state and recharged when the pressure falls below 90% of the manufacturer's recommended pressure level. The regulator, and all warning devices must be inspected to ensure proper function. Straps and other items must be inspected for signs of deterioration. Check hydrostatic test date on air bottle(s). Records of monthly inspections must be completed using the form included in **Appendix B**.

7.4 **Repair**

Respirators that fail to pass inspection or are otherwise found to be defective must be removed from service, and discarded, repaired, or adjusted. Due to the complex nature of components such as reducing and admission valves, regulators, and alarms only the respirator manufacturer, or technicians trained by the manufacturer, may complete respirator repairs on respirators used by Rensselaer employees. Only NIOSH and manufacturers approved parts will be used to repair respirators. In the event that a respirator must be sent out for repair and/or service, the Rensselaer employee will be given a replacement respirator of the same make, model and size.

Section 8. Employee Training and Information

8.1 **Scope and Applicability**

Training is an essential part of appropriate respiratory protection selection, usage and maintenance. Rensselaer has established a training program that includes (at a minimum):

- The general requirements of OSHA's respiratory protection standard
- Respiratory hazards identification
- Proper respirator selection
- Procedures for inspecting, wearing and seal checking a respirator
- Information regarding the potential consequences of improper fit, usage and/or maintenance
- Respirator limitations
- Proper procedures for maintenance and storage
- Recognizing medical signs and symptoms that may limit or prevent the use of respirators

8.2 **Frequency**

Respiratory training is required for individuals under the following conditions:

- Before a respirator is used by an individual at Rensselaer (Initial)
- Situations in which changes in the type of respirator assigned to an employee render previous training obsolete
- Any situations that may arise that show that the employee lacks sufficient respiratory protection knowledge to have adequate protection.
- At least annually

Section 9. Program Evaluation

9.1 Conducting Program Evaluations

The ***Office of Environmental Health and Safety*** will conduct periodic evaluations, as necessary, to ensure that employees of Rensselaer are following the provisions of this program. The evaluations will be used to determine the effectiveness of training programs and to ensure that respiratory protection is being utilized correctly.

9.2 Employee Consultations

Employee consultations may be utilized by the ***Office of Environmental Health and Safety*** to ascertain employee's views on program effectiveness and to identify any problem areas. Such consultations may also include respirator inspections designed to ensure that proper usage, maintenance and selection processes are being observed.

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Appendix A- Assigned Protection Factors

Table of APFs for various types of Respirators

Respirator Class and Type	***OSHA***	***NIOSH***
Air Purifying		
Filtering Facepiece	10	10
Half-Mask	10	10
Full-Facepiece	50	50
Powered Air Purifying		
Half-Mask	50	50
Full-Facepiece	250	50
Loose Fitting Facepiece	25	25
Hood or Helmet	25	25
Supplied Air		
Half-Mask-Demand	10	10
Half-Mask-Continuous	50	50
Half-Mask-Pressure Demand	1000	1000
Full-Facepiece Demand	50	50
Full-Facepiece Continuous Flow	250	50
Full-Facepiece Pressure Demand	1000	2000
Loose Fitting Facepiece	25	25
Hood or Helmet	25	25
Self Contained Breathing Apparatus (SCBA)		
Demand	50	50
Pressure Demand	>1000	10,000

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Appendix B- SCBA Monthly Inspection Form

Model #_____ Serial #_____ Year_____

Initial each box after item is inspected and deemed to be in an acceptable condition

Item	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Mask and Hose-Examine for contamination, damage, and deterioration												
Examine Harness for wear and function of hardware												
Test Unit as Worn (Regulator attached to cylinder)												
Check cylinder gauge for "full" indication												
Close cylinder valve. Compare regulator gauge to cylinder gauge (+ or- 50 P.S.I. is allowable)												
Watch regulator gauge for drop in reading, which would indicate leakage. (One increment on gauge in 5 minutes is allowable)												
Breathe unit down until alarm starts. Check regulator gauge for indication of pressure. Alarm should start at about ¼ full.												
Close main line valve, open and close cylinder valve												
Slightly breathe on regulator to check shut off valve. Regulator should not flow.												
Open main line valve full and lock. Open by-pass and bleed off pressure												
Face piece. Inspect lens for cracks or large scratches												
Hydrostatic Test date on air cylinder(s)												

This form must be forwarded to the Program Administrator on a monthly basis.

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Appendix C- Non-Mandatory Use Informational Form

In accordance with OSHA regulation **29 CFR 1910.134,** the following information is provided for your review. Signing of this form indicates that you have received the regulatory appendix, and understand it's content.

Appendix D to Sec. 1910.134 (Mandatory) Information for Employees Using Respirators When Not Required Under the Standard

Respirators are an effective method of protection against designated hazards when properly selected and worn. Respirator use is encouraged, even when exposures are below the exposure limit, to provide an additional level of comfort and protection for workers. However, if a respirator is used improperly or not kept clean, the respirator itself can become a hazard to the worker. Sometimes, workers may wear respirators to avoid exposures to hazards, even if the amount of hazardous substance does not exceed the limits set by OSHA standards. If your employer provides respirators for your voluntary use, of if you provide your own respirator, you need to take certain precautions to be sure that the respirator itself does not present a hazard.

You should do the following:

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

2. Choose respirators certified for use to protect against the contaminant of concern. NIOSH, the National Institute for Occupational Safety and Health of the U.S. Department of Health and Human Services, certifies respirators. A label or statement of certification should appear on the respirator or respirator packaging. It will tell you what the respirator is designed for and how much it will protect you.

3. Do not wear your respirator into atmospheres containing contaminants for which your respirator is not designed to protect against. For example, a respirator designed to filter dust particles will not protect you against gases, vapors, or very small solid particles of fumes or smoke.

4. Keep track of your respirator so that you do not mistakenly use someone else's respirator. [63 FR 1152, Jan. 8, 1998; 63 FR 20098, April 23, 1998

Employee Signature:_____ Date:_____

Witness:_____ Date:_____

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Appendix D: Fit Test Documentation Form

Name of Employee:_____ Date:_____

Employee Signature:_____

Fit-Test Conducted by:_____ Date:_____

Signature:_____

Testing Result Information

☐ Qualitative Fit-Test Record

Type of Mask:_____

Manufacturer:_____

Model:_____

Size_____

Irritant used: Isoamyl Acetate
Stannic Chloride

Other:_____

Pass Fail
(circle one)

Additional Comments:_____

_____

_____

_____

Next Fit-Test Due Before:
_____/_____/_____

☐ Quantitative Fit-Test Record

Type of Mask:_____

Manufacturer:_____

Model:_____

Size_____

Results:_____

_____

Pass Fail
(circle one)

Additional Comments:_____

_____

_____

_____

Next Fit-Test Due Before:
_____/_____/_____

Rensselaer

Appendix E: User Profile for Licensed Health Care Professional

Name of Employee:_____ Date:_____

Employee Signature:_____

Name of Supervisor:_____ Date:_____

Signature:_____

Expected User Profile

1. The type and weight of the respirator to be worn by the employee:
   _____
2. The estimated duration and frequency of respirator use:
   _____
3. The tasks the employee may be completing while wearing the respirator:
   _____
4. Additional Personal Protective Equipment that the employee may be required to wear:
   _____
5. The temperature and humidity extremes that may be encountered in the work area:
   _____

Name of Licensed Health Care Professional Receiving User Profile:_____

Date:_____ Signature:_____

Return this form to the Rensselaer Respiratory Protection Program Administrator upon completion.