

Respiratory Protection Program

Environmental Health & Safety

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1. Policy Statement: It is the responsibility of the Georgia Institute of Technology to provide employees with a safe and healthful work environment. This respiratory protection program

establishes the circumstances when respirators shall be to protect employees and the procedures necessary for implementation of an adequate respiratory protection program.

2. Scope: This plan covers all GA Tech employees (faculty and staff) and students.

3. Responsibilities:

3.1. Environmental Health and Safety:

- 3.1.1. Administration of the GT Respiratory Protection Program
- 3.1.2. Anticipating and evaluating workplace respiratory hazards.
- 3.1.3. Conducting air sampling on routine and non-routine tasks to evaluate and quantify the level of respiratory hazard.
- 3.1.4. Suggesting appropriate feasible engineering or administrative controls to control/reduce human exposure to airborne contaminants whenever possible.
- 3.1.5. Administration of the Program Elements as per Section 7

3.2. Department management:

- 3.2.1. Bringing questions about respiratory safety to the attention of EH&S.
- 3.2.2. Alerting EH&S about new products or processes in the workplace.
- 3.2.3. Informing EH&S about new employees whose jobs require the use of respirators.
- 3.2.4. Ensuring that employees who are not enrolled in the respiratory protection program do not possess or use respirators on GT property.
- 3.2.5. Ensuring that persons who need to be enrolled in the respiratory protection program have received medical clearance prior to fit testing.
- 3.2.6. Ensuring that respirators are not issued to persons not enrolled in the respiratory protection program (except for filtering face pieces) until after they have been medically qualified, fit tested and trained in respiratory safety.
- 3.2.7. Ensuring that only respirators approved by EH&S are used and issued at GA Tech.
- 3.2.8. Ensuring that employees do not use respirators for tasks other than those for which the respirator was originally issued without first consulting EH&S.
- 3.2.9. Ensuring that employees who request filtering face pieces are provided with a copy of Appendix D of the Respiratory Standard- Information for Employees Using Respirators When Not Required Under Standard. (Appendix B of this Program).

3.3. Respirator users:

- 3.3.1. Understanding the hazards in their workplace.
- 3.3.2. Understanding the limitations of the respirator(s) which they have been issued.
- 3.3.3. Using only respiratory protective equipment which has been issued to them at GT for the specific tasks/hazards for which it was issued.
- 3.3.4. Following the procedures described in the training section of this program for inspecting, repairing, donning, using, cleaning and storing their respirators.
- 3.3.5. Protecting facepiece seal by remaining clean shaven so that there is no facial hair that comes between sealing surface of the facepiece and the face or that interferes with valve function such as but not limited to: sideburns, large mustaches, goatees, day old stubble
- 3.3.6. Employees who may be called on to wear a respirator are required to report to work clean shaven. Failure to do so may result in disciplinary action.
- 3.3.7. Consulting a supervisor before using a respirator on a process/procedure other than the one for which it was issued.

4. Reference:

- 4.1. Law: None
- 4.2. *Legally non-binding regulations:* Code of Federal Regulations 29.1910.134 Respiratory Protection
- 4.3. *Consensus Standard:* American Conference of Governmental Industrial Hygienists Threshold Limit Value (ACGIH TLV)
- 4.4. Pertinent Guidance:

4.4.1. National Institutes of Occupational Safety and Health (NIOSH) Sampling Methods

4.4.2. NIOSH Respirator Decision Logic

5. Risk Assessment:

5.1. Respiratory hazard shall be defined as any situation which puts GT personnel at risk for:

1. Exposure to chemicals by inhalation in excess of established limits (OSHA PEL, ACGIH TLV).
2. Exposure to biological agents classified as Bio-Safety Level 2 or above (capable of causing illness in humans by means of respiratory exposure)
3. Exposure to oxygen deficient atmospheres
4. Exposure to unknown atmospheres

5.2. Hazard Quantification: Whenever possible, degree of hazard will be quantitatively assessed by air sampling using approved NIOSH sampling methods.

5.3. Hazards for which respirators may be worn:

5. Inhalation hazard
6. Ingestion hazard
7. Eye/face protection from gases/vapors
8. Emergency operation where chemicals, biohazards, or combustion products are present

5.4. Exposed population:

9. Faculty
10. Staff
11. Students

6. **Objective:** To prevent over exposures to harmful agents and to avoid/limit unnecessary exposures whenever possible. (See Program Elements)

7. Program Elements:

7.1. Air Monitoring:

7.1.1. Shall be accomplished whenever possible to identify and quantify the level of respiratory hazard

7.1.2. Shall be re-evaluated annually

7.1.3. Shall be accomplished whenever there is a change in a process that might affect worker exposure

7.2. Respirator Selection:

7.2.1. The EH&S Department of GA Tech is the sole entity on campus with the necessary qualifications to determine the need for and to select appropriate respirators

7.2.2. Respirators will only be used in situations where engineering controls are not feasible or while engineering controls are being installed.

7.2.3. Respirator selection shall be made on the basis of hazard identification (biological, chemical, low oxygen content).

7.2.4. Air sampling shall be performed whenever possible, to validate respirator selection.

7.2.5. Only respirators certified by the National Institute for Occupational Safety and Health (NIOSH) as being appropriate for the contaminant in question shall be used.

7.2.6. Respirator accessories such as cartridges, air lines, connectors, replacement parts, and SCBA cylinders shall be chosen according to manufacturer's specifications

7.3. Medical Qualification:

7.3.1. All persons enrolled in the respiratory protection plan will be medically qualified to wear a respirator prior to being fit tested or issued a respirator

7.3.2. Medical Qualification is to be done by a Physician or Licensed Health Care Professional (PLHCP) using the OSHA Medical Questionnaire at Appendix A of this Program.

- 7.3.3. The PLHCP shall be provided information about respirator type, respirator weight, duration and frequency of use, and level of activity during use by EH&S prior to qualification.
- 7.3.4. Periodic re-qualification shall be accomplished according to the schedule recommended by the PLHCP and may vary according to the employee's health history and age.
- 7.3.5. Persons who elect to wear filtering face pieces for comfort measures do not need to pass a medical qualification
- 7.4. Training: All persons who are issued respirators will be trained in the following: (the general training text is at Appendix D)
 - 7.4.1. Respiratory hazards that make respirator use mandatory.
 - 7.4.2. Types of respirators and their limitations
 - 7.4.3. Negative pressure respirators
 - 7.4.3.1. Air Purifying Respirators (APR)
 - 7.4.4. Positive pressure respirators
 - 7.4.4.1. Self Contained Breathing apparatus (SCBA)
 - 7.4.4.2. Supplied Air (airline) tight-fitting and loose-fitting (hood and helmet)
 - 7.4.4.3. Powered Air Purifying Respirator (PAPR)
 - 7.4.5. Filtering facepieces
 - 7.4.6. APR cartridge selection
 - 7.4.6.1. How to install and remove
 - 7.4.6.2. Change out schedule
 - 7.4.7. How to inspect the respirator
 - 7.4.8. How to don and adjust the respirator
 - 7.4.9. Positive and negative seal checks
 - 7.4.10. How to clean and repair the respirator
 - 7.4.11. How to store the respirator
- 7.5. Refresher training: Will be given annually to coincide with annual fit testing
- 7.6. Competence: Confirmation will be accomplished after each training session in the form of a written exam
- 7.7. Fit Testing:
 - 7.7.1. Fit testing shall be accomplished only by persons qualified to do so by training or experience by EH&S or an EH&S designee.
 - 7.7.2. Whenever possible, quantitative fit testing will be used. This procedure can be found in appendix C-2.
 - 7.7.3. When quantitative fit testing is not possible, qualitative fit testing by the Bitrex™ or Saccharin Aerosol Method will be used at Appendix C-4 or C-3.
 - 7.7.4. When it is determined that the test subject cannot taste the Bitrex™ solution (Test Procedure Part A- Taste Threshold Screening) or at the tester's discretion, the Irritant Smoke Method will be used at Appendix C-5.
- 7.8. Fit testing shall be re-accomplished annually or whenever there may have been a change in the shape of the employee's face as might be caused by a significant weight gain/loss, injury to the face or jaw, or the introduction/change in dental appliances.
- 7.9. Breathing Air Quality
 - 7.9.1. Self Contained Breathing Apparatus
 - 7.9.1.1. Compressed breathing air shall at least meet the requirements of Type 1-Grade D breathing air as per the ANSI/Compressed Gas Association Specification for Air, G-7.1-1989 to include:
 - 7.9.1.1.1. Oxygen content (v/v) of 19.5%-23.5%.
 - 7.9.1.1.2. Condensed hydrocarbons content of no greater than 5mg/m³ of air.
 - 7.9.1.1.3. Carbon monoxide content of no greater than 10 PPM.

- 7.9.1.1.4. Lack of noticeable odor.
- 7.9.1.1.5. Moisture content not to exceed dew point of -50°F at 1 ATM pressure.
- 7.9.1.2. Cylinders are to be hydrostatically tested every 3 years as per DOT Regulation 49 CFR Parts 173 and 178
- 7.9.1.3. Cylinders of purchased breathing air must be accompanied by a certificate of analysis from the supplier indicating that the air meets the requirements for Type 1-Grade D breathing air as outlined in 7.9.1.1.
- 7.9.2. Air Line Respirator
 - 7.9.2.1. Compressors for supplying Air Line Respirators shall have suitable in line sorbent beds to ensure breathing air quality equivalent to Type 1 Grad D breathing air as outlined in 7.9.1.1
 - 7.9.2.2. All compressors are to have an in line carbon monoxide sensor/alarm.
 - 7.9.2.3. Sorbent beds and filters are to be changed according to the manufacturer's specifications. A tag, indicating the required frequency of change outs and the date of the most recent change out is to be maintained at the compressor.
 - 7.9.2.4. Oil lubricated and non-oil lubricated compressors are to be tested when first put into service and every 6 months afterwards. Compressors which fail testing are to be tagged and removed from service until repairs are made, re-testing is accomplished, and breathing air meets Grad D specifications.
 - 7.9.2.5. Compressors, either stationary or mobile are to be constructed and situated so as to prevent entry of contaminated air into the air supply system.
- 7.10. Voluntary use of respirators:
 - 7.10.1. This program does not allow the voluntary use of tight fitting, hood, or helmet respirators by persons not already enrolled in the respiratory protection program for mandatory respirator use.
 - 7.10.2. The voluntary use of filtering facepieces (dust masks) for comfort measures and as a general face protector for dusty processes which do not approach the ACGIH TLV for nuisance dust (10 mg/m^3) is allowed with prior approval by GT EHS.
 - 7.10.3. All persons who are issued filtering face pieces shall receive a copy of Appendix D of the Respiratory Standard- Information for Employees Using Respirators When not Required Under Standard (Appendix B of this Program).
- 7.11. Documentation:
 - 7.11.1. Medical Records: Shall be maintained by the PLHCP and shall be made available, upon request to the employee.
 - 7.11.2. Qualification Certificate: Will be maintained in the employee's personnel file and also at EH&S
 - 7.11.3. Fit test Records: Will be maintained in the employee's personnel file and also at EH&S
 - 7.11.4. Air/Exposure Monitoring Records: Shall be maintained by EH&S and kept indefinitely.
 - 7.11.5. Training Records: Shall be maintained by EH&S for length of employment + 3 years.
 - 7.11.6. Program Evaluation Records: Shall be maintained by EH&S for 3 years
- 7.12. Performance Measure (Program Effectiveness): EHS will conduct annual program effectiveness evaluations which will consider:
 - 7.12.1. Respirator User Metrics:
 - 7.12.1.1. Do randomly selected respirator users understand the hazards involved in their jobs/why they need a respirator?
 - 7.12.1.2. Can randomly selected respirator users demonstrate how to don and doff the respirator and also perform positive and negative pressure seal checks (APRs only)?
 - 7.12.2. Air Monitoring:
 - 7.12.2.1. Is it being accomplished when new products or process changes are introduced?
 - 7.12.2.2. Is it being re-evaluated annually for routine tasks requiring respirator use?

7.12.3. Are SCBA cylinders hydrostatically tested every 3 years?

7.12.3.1. Is compressor output being tested annually?

7.12.3.2. Are filter/sorbent bed change out records indicated by a tag at the compressor?

7.12.3.3. Are cylinders of purchased breathing air accompanied by a certificate of analysis from the supplier indicating that the air meets the requirements for Type 1-Grade D breathing air?

7.12.4. Breathing air quality

7.12.5. Fit testing: Is fit testing re-accomplished annually?

7.12.6. Training: Is training re-accomplished annually?

8. Non-Conformance and Corrective Action

8.1. Individuals who do not conform to the conditions specified in the program may lose their respirator privileges until they can re-accomplish training.

8.2. Repeat violations of respiratory protection rules may result in a revocation of permission to use a respirator.

9. Accident Investigation: Mishaps involving respirator use will be investigated by EH&S.

9.1. Investigation Results: Investigation results will be reviewed by the GT Chemical and Environmental Safety Committee who will make suggestions for improving deficiencies.

Appendix A – Medical Evaluation Questionnaire

From Appendix C to Sec. 1910.134: OSHA Respirator Medical Evaluation Questionnaire
(Mandatory)

To the employer: Answers to questions in Section 1, and to question 9 in Section 2 of Part A, do not require a medical examination.

To the employee: Can you read (circle one): Yes / No

Your employer must allow you to answer this questionnaire during normal working hours, or at a time and place that is convenient to you. To maintain your confidentiality, your employer or supervisor must not look at or review your answers, and your employer must tell you how to deliver or send this questionnaire to the health care professional who will review it.

Part A. Section 1 (Mandatory)

The following information must be provided by every employee who has been selected to use any type of respirator (please print).

Today's date: _____

Your name: _____

Your age (to nearest year): _____

Sex (circle one): Male / Female

Your height: _____ ft. _____ in.

Your weight: _____ lbs.

Your job title: _____

A phone number where you can be reached by the health care professional who reviews this questionnaire (include the Area Code): _____

The best time to phone you at this number: _____

Has your employer told you how to contact the health care professional who will review this questionnaire (circle one): Yes / No

Check the type of respirator you will use (you can check more than one category):

- a. _____ N, R, or P disposable respirator (filter-mask, non- cartridge type only).
- b. _____ Other type (for example, half- or full-facepiece type, powered-air purifying, supplied-air, self-contained breathing apparatus).

Have you worn a respirator (circle one): Yes / No

If "yes," what type(s): _____

Part A. Section 2. (Mandatory) Questions 1 through 9 below must be answered by every employee who has been selected to use any type of respirator (please circle "yes" or "no").

Do you currently smoke tobacco, or have you smoked tobacco in the last month: Yes / No

Have you ever had any of the following conditions?

Seizures (fits): Yes/No

Diabetes (sugar disease): Yes/No

Allergic reactions that interfere with your breathing: Yes/No

Claustrophobia (fear of closed-in places): Yes/No

Trouble smelling odors: Yes/No

Have you ever had any of the following pulmonary or lung problems?

Asbestosis: Yes/No

Asthma: Yes/No

Chronic bronchitis: Yes/No

Emphysema: Yes/No

Pneumonia: Yes/No

Tuberculosis: Yes/No

Silicosis: Yes/No

Pneumothorax (collapsed lung): Yes/No

Lung cancer: Yes/No

Broken ribs: Yes/No

Any chest injuries or surgeries: Yes/No

Any other lung problem that you've been told about: Yes/No

Do you currently have any of the following symptoms of pulmonary or lung illness?

Shortness of breath: Yes/No

Shortness of breath when walking fast on level ground or walking up a slight hill or incline: Yes/No

Shortness of breath when walking with other people at an ordinary pace on level ground: Yes/No

Have to stop for breath when walking at your own pace on level ground: Yes/No

Shortness of breath when washing or dressing yourself: Yes/No

Shortness of breath that interferes with your job: Yes/No

Coughing that produces phlegm (thick sputum): Yes/No

Coughing that wakes you early in the morning: Yes/No

Coughing that occurs mostly when you are lying down: Yes/No

Coughing up blood in the last month: Yes/No

Wheezing: Yes/No

Wheezing that interferes with your job: Yes/No

Chest pain when you breathe deeply: Yes/No

Any other symptoms that you think may be related to lung problems: Yes/No

Have you ever had any of the following cardiovascular or heart problems?

Heart attack: Yes/No

Stroke: Yes/No

Angina: Yes/No

Heart failure: Yes/No

Swelling in your legs or feet (not caused by walking): Yes/No

Heart arrhythmia (heart beating irregularly): Yes/No

High blood pressure: Yes/No

Any other heart problem that you've been told about: Yes/No

Have you ever had any of the following cardiovascular or heart symptoms?

Frequent pain or tightness in your chest: Yes/No

Pain or tightness in your chest during physical activity: Yes/No

Pain or tightness in your chest that interferes with your job: Yes/No

In the past two years, have you noticed your heart skipping or missing a beat: Yes/No

Heartburn or indigestion that is not related to eating: Yes/ No

Any other symptoms that you think may be related to heart or circulation problems: Yes/No

Do you currently take medication for any of the following problems?

Breathing or lung problems: Yes/No

Heart trouble: Yes/No

Blood pressure: Yes/No

Seizures (fits): Yes/No

If you've used a respirator, have you ever had any of the following problems? (If you've never used a respirator, check the following space and go to question 11)

Eye irritation: Yes/No

Skin allergies or rashes: Yes/No

Anxiety: Yes/No

General weakness or fatigue: Yes/No

Any other problem that interferes with your use of a respirator: Yes/No

Would you like to talk to the health care professional who will review this questionnaire about your answers to this questionnaire: Yes/No

Questions 12 to 18 below must be answered by every employee who has been selected to use either a full-facepiece respirator or a self-contained breathing apparatus (SCBA). For employees who have been selected to use other types of respirators, answering these questions is voluntary.

Have you ever lost vision in either eye (temporarily or permanently): Yes/No

Do you currently have any of the following vision problems?

Wear contact lenses: Yes/No

Wear glasses: Yes/No

Color blind: Yes/No

Any other eye or vision problem: Yes/No

Have you ever had an injury to your ears, including a broken ear drum: Yes/No

Do you currently have any of the following hearing problems?

Difficulty hearing: Yes/No

Wear a hearing aid: Yes/No

Any other hearing or ear problem: Yes/No

Have you ever had a back injury: Yes/No

Do you currently have any of the following musculoskeletal problems?

Weakness in any of your arms, hands, legs, or feet: Yes/No

Back pain: Yes/No

Difficulty fully moving your arms and legs: Yes/No

Pain or stiffness when you lean forward or backward at the waist: Yes/No

Difficulty fully moving your head up or down: Yes/No

Difficulty fully moving your head side to side: Yes/No

Difficulty bending at your knees: Yes/No

Difficulty squatting to the ground: Yes/No

Climbing a flight of stairs or a ladder carrying more than 25 lbs: Yes/No

Any other muscle or skeletal problem that interferes with using a respirator: Yes/No

Part B Any of the following questions, and other questions not listed, may be added to the questionnaire at the discretion of the health care professional who will review the questionnaire.

In your present job, are you working at high altitudes (over 5,000 feet) or in a place that has lower than normal amounts of oxygen: Yes/No

If "yes," do you have feelings of dizziness, shortness of breath, pounding in your chest, or other symptoms when you're working under these conditions: Yes/No

At work or at home, have you ever been exposed to hazardous solvents, hazardous airborne chemicals (e.g., gases, fumes, or dust), or have you come into skin contact with hazardous chemicals: Yes/No

If "yes," name the chemicals if you know them: _____

Have you ever worked with any of the materials, or under any of the conditions, listed below:

Asbestos: Yes/No

Silica (e.g., in sandblasting): Yes/No

Tungsten/cobalt (e.g., grinding or welding this material): Yes/No

Beryllium: Yes/No

Aluminum: Yes/No

Coal (for example, mining): Yes/No

Iron: Yes/No

Tin: Yes/No

Dusty environments: Yes/No

Any other hazardous exposures: Yes/No

If "yes," describe these exposures: _____

List any second jobs or side businesses you have: _____

List your previous occupations: _____

List your current and previous hobbies: _____

Have you been in the military services? Yes/No

If "yes," were you exposed to biological or chemical agents (either in training or combat): Yes/No

Have you ever worked on a HAZMAT team? Yes/No

Other than medications for breathing and lung problems, heart trouble, blood pressure, and seizures mentioned earlier in this questionnaire, are you taking any other medications for any reason (including over-the-counter medications): Yes/No

If "yes," name the medications if you know them:

Will you be using any of the following items with your respirator(s)?

HEPA Filters: Yes/No

Canisters (for example, gas masks): Yes/No

Cartridges: Yes/No

How often are you expected to use the respirator(s)? (Circle "yes" or "no" for all answers that apply to you)

Escape only (no rescue): Yes/No

Emergency rescue only: Yes/No

Less than 5 hours per week: Yes/No

Less than 2 hours per day: Yes/No

2 to 4 hours per day: Yes/No

Over 4 hours per day: Yes/No

During the period you are using the respirator(s), is your work effort:

Light (less than 200 kcal per hour): Yes/No

If "yes," how long does this period last during the average shift: _____ hrs. _____ mins. Examples of a light work effort are sitting while writing, typing, drafting, or performing light assembly work; or standing while operating a drill press (1-3 lbs.) or controlling machines.

Moderate (200 to 350 kcal per hour): Yes/No

If "yes," how long does this period last during the average shift: _____ hrs. _____ mins. Examples of moderate work effort are sitting while nailing or filing; driving a truck or bus in urban traffic; standing while drilling, nailing, performing assembly work, or transferring a moderate load (about 35 lbs.) at trunk level; walking on a level surface about 2 mph or down a 5-degree grade about 3 mph; or pushing a wheelbarrow with a heavy load (about 100 lbs.) on a level surface.

Heavy (above 350 kcal per hour): Yes/No

If "yes," how long does this period last during the average shift: _____ hrs. _____ mins. Examples of heavy work are lifting a heavy load (about 50 lbs.) from the floor to your waist or shoulder; working on a loading dock; shoveling; standing while bricklaying or chipping castings; walking up an 8-degree grade about 2 mph; climbing stairs with a heavy load (about 50 lbs.).

Will you be wearing protective clothing and/or equipment (other than the respirator) when you're using your respirator: Yes/No

If "yes," describe this protective clothing and/or equipment: _____

Will you be working under hot conditions (temperature exceeding 77 deg. F): Yes/No

Will you be working under humid conditions: Yes/No

Describe the work you'll be doing while you're using your respirator(s):

Describe any special or hazardous conditions you might encounter when you're using your respirator(s) (for example, confined spaces, life-threatening gases):

Provide the following information, if you know it, for each toxic substance that you'll be exposed to when you're using your respirator(s):

Name of the first toxic substance: _____

Estimated maximum exposure level per shift: _____

Duration of exposure per shift: _____

Name of the second toxic substance: _____

Estimated maximum exposure level per shift: _____

Duration of exposure per shift: _____

Name of the third toxic substance:

Estimated maximum exposure level per
shift:_____

Duration of exposure per
shift:_____

The name of any other toxic substances that you'll be exposed to while using your
respirator:_____

Describe any special responsibilities you'll have while using your respirator(s) that may affect the
safety and well-being of others (for example, rescue, security):

[63 FR 1152, Jan. 8, 1998; 63 FR 20098, April 23, 1998]

Appendix B For Users of Filtering Facepieces

From Appendix D to Sec. 1910.134 (Mandatory)

Information for Employees Using Respirators When Not Required Under the Standard

This form is for Georgia Tech affiliates who wish to voluntarily use disposable N-95 respirators for exposures below the relevant exposure standards. The use of N-95 respirators, even in a voluntary capacity, still requires the prior approval of the Environmental Health and Safety (EHS) Office at Georgia Tech. If you do not have prior approval, please contact EHS at 404-894-4635. The use of N-95 respirators through this form is strictly voluntary and shall not be required.

OSHA requires that the following information be provided to anyone considering the voluntary use of a respirator:

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

You should do the following:

1. Read and heed all instructions provided by the manufacturer on use, maintenance, cleaning and care, and warnings regarding the respirators limitations.
2. Choose respirators certified for use to protect against the contaminant of concern. NIOSH, the National Institute for Occupational Safety and Health of the U.S. Department of Health and Human Services, certifies respirators. A label or statement of certification should appear on the respirator or respirator packaging. It will tell you what the respirator is designed for and how much it will protect you.
3. Do not wear 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.

Limitations of N-95 Respirators:

N-95's are only effective against particulate aerosols free of oil or vapors and should not be used under the following conditions:

- Not for use in atmospheres containing less than 19.5% oxygen
- Not for use in Immediately Dangerous to Life and Health (IDLH) or unknown atmospheres
- Not effective against gases or vapors (includes paint spraying and fumigation, etc.)
- Not effective against oil-based aerosols or asbestos

Agreement:

I have read and understood the above content and agree to abide by its recommendations. I understand that this form only covers the use of N-95 respirators and that all other respirator use is subject to the Georgia Tech Respiratory Protection Program under the Environmental Health and Safety Office.

Print Name

Signature

Date

Appendix C-1 Test Exercises

The following test exercises are to be performed for all fit testing methods prescribed in this appendix. The test subject shall perform exercises, in the test environment, in the following manner:

Normal breathing. In a normal standing position, without talking, the subject shall breathe normally.

Deep breathing. In a normal standing position, the subject shall breathe slowly and deeply, taking caution so as not to hyperventilate.

Turning head side to side. Standing in place, the subject shall slowly turn his/her head from side to side between the extreme positions on each side. The head shall be held at each extreme momentarily so the subject can inhale at each side.

Moving head up and down. Standing in place, the subject shall slowly move his/her head up and down. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling).

Talking. The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the Rainbow Passage, count backward from 100, or recite a memorized poem or song.

Rainbow Passage When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

Grimace. The test subject shall grimace by smiling or frowning. (This applies only to QNFT testing; it is not performed for QLFT)

Bending over. The test subject shall bend at the waist as if he/she were to touch his/her toes. Jogging in place shall be substituted for this exercise in those test environments such as shroud type QNFT or QLFT units that do not permit bending over at the waist.

Normal breathing. Same as exercise (1).

Each test exercise shall be performed for one minute except for the grimace exercise which shall be performed for 15 seconds. The test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried. The respirator shall not be adjusted once the fit test exercises begin. Any adjustment voids the test, and the fit test must be repeated.

Appendix C-2 Quantitative Fit Test Method (Portacount™)

Check the respirator to make sure the sampling probe and line are properly attached to the facepiece and that the respirator is fitted with a particulate filter capable of preventing significant penetration by the ambient particles used for the fit test (e.g., NIOSH 42 CFR 84 series 100, series 99, or series 95 particulate filter) per manufacturer's instruction.

Instruct the person to be tested to don the respirator for five minutes before the fit test starts. This purges the ambient particles trapped inside the respirator and permits the wearer to make certain the respirator is comfortable. This individual shall already have been trained on how to wear the respirator properly.

Check the following conditions for the adequacy of the respirator fit: Chin properly placed; Adequate strap tension, not overly tightened; Fit across nose bridge; Respirator of proper size to span distance from nose to chin; Tendency of the respirator to slip; Self-observation in a mirror to evaluate fit and respirator position.

Have the person wearing the respirator do a user seal check. If leakage is detected, determine the cause. If leakage is from a poorly fitting facepiece, try another size of the same model respirator, or another model of respirator.

Follow the manufacturer's instructions for operating the Portacount and proceed with the test.

The test subject shall be instructed to perform the exercises as described in Appendix C-1 of this Program.

After the test exercises, the test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried.

Portacount™ Test Instrument

The Portacount™ will automatically stop and calculate the overall fit factor for the entire set of exercises. The overall fit factor is what counts. The Pass or Fail message will indicate whether or not the test was successful. If the test was a Pass, the fit test is over.

Since the pass or fail criterion of the Portacount™ is user programmable, the test operator shall ensure that the pass or fail criterion meet the requirements for minimum respirator performance in this appendix.

A record of the test needs to be kept on file, assuming the fit test was successful. The record must contain the test subject's name; overall fit factor; make, model, style, and size of respirator used; and date tested.

Appendix C-3 Qualitative Fit Test Method: Saccharin Protocol

Saccharin Solution Aerosol Protocol

The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) *Taste Threshold Screening*

The saccharin taste threshold screening, performed without wearing a respirator, is intended to determine whether the individual being tested can detect the taste of saccharin.

- (1) During threshold screening as well as during fit testing, subjects shall wear an enclosure about the head and shoulders that is approximately 12 inches in diameter by 14 inches tall with at least the front portion clear and that allows free movements of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly, parts # FT 14 and # FT 15 combined, is adequate.
- (2) The test enclosure shall have a 3/4-inch (1.9 cm) hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.
- (3) The test subject shall don the test enclosure. Throughout the threshold screening test, the test subject shall breathe through his/her slightly open mouth with tongue extended. The subject is instructed to report when he/she detects a sweet taste.
- (4) Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the test conductor shall spray the threshold check solution into the enclosure. The nozzle is directed away from the nose and mouth of the person. This nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.
- (5) The threshold check solution is prepared by dissolving 0.83 gram of sodium saccharin USP in 100 ml of warm water. It can be prepared by putting 1 ml of the fit test solution in 100 ml of distilled water.
- (6) To produce the aerosol, the nebulizer bulb is firmly squeezed so that it collapses completely, then released and allowed to fully expand.
- (7) Ten squeezes are repeated rapidly and then the test subject is asked whether the saccharin can be tasted. If the test subject reports tasting the sweet taste during the ten squeezes, the screening test is completed. The taste threshold is noted as ten regardless of the number of squeezes actually completed.
- (8) If the first response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted. If the test subject reports tasting the sweet taste during the second ten squeezes, the screening test is completed. The taste threshold is noted as twenty regardless of the number of squeezes actually completed.
- (9) If the second response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted. If the test subject reports tasting the sweet taste during the third set of ten squeezes, the screening test is completed. The taste threshold is noted as thirty regardless of the number of squeezes actually completed.

- (10) The test conductor will take note of the number of squeezes required to solicit a taste response.
- (11) If the saccharin is not tasted after 30 squeezes (step 10), the test subject is unable to taste saccharin and may not perform the saccharin fit test.

Note to paragraph 3. (a): If the test subject eats or drinks something sweet before the screening test, he/she may be unable to taste the weak saccharin solution.

- (12) If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.
- (13) Correct use of the nebulizer means that approximately 1 ml of liquid is used at a time in the nebulizer body.
- (14) The nebulizer shall be thoroughly rinsed in water, shaken dry, and refilled at least each morning and afternoon or at least every four hours.

(b) Saccharin Solution Aerosol Fit Test Procedure

- (1) The test subject may not eat, drink (except plain water), smoke, or chew gum for 15 minutes before the test.
- (2) The fit test uses the same enclosure described in 3. (a) above.
- (3) The test subject shall don the enclosure while wearing the respirator selected according to Section 7.2 of this Program. The respirator shall be properly adjusted and equipped with a particulate filter(s).
- (4) A second DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.
- (5) The fit test solution is prepared by adding 83 grams of sodium saccharin to 100 ml of warm water.
- (6) As before, the test subject shall breathe through the slightly open mouth with tongue extended, and report if he/she tastes the sweet taste of saccharin.
- (7) The nebulizer is inserted into the hole in the front of the enclosure and an initial concentration of saccharin fit test solution is sprayed into the enclosure using the same number of squeezes (either 10, 20 or 30 squeezes) based on the number of squeezes required to elicit a taste response as noted during the screening test. A minimum of 10 squeezes is required.
- (8) After generating the aerosol, the test subject shall be instructed to perform the exercises in Appendix C-1 of this Program.
- (9) Every 30 seconds the aerosol concentration shall be replenished using one half the original number of squeezes used initially (e.g., 5, 10 or 15).
- (10) The test subject shall indicate to the test conductor if at any time during the fit test the taste of saccharin is detected. If the test subject does not report tasting the saccharin, the test is passed.

(11) If the taste of saccharin is detected, the fit is deemed unsatisfactory and the test is failed. A different respirator shall be tried and the entire test procedure is repeated (taste threshold screening and fit testing).

(12) Since the nebulizer has a tendency to clog during use, the test operator must make periodic checks of the nebulizer to ensure that it is not clogged. If clogging is found at the end of the test session, the test is invalid.

Appendix C-4 Qualitative Fit Test Method: Denatonium Benzoate (Bitrex™) Protocol

The Bitrex™ (Denatonium benzoate) solution aerosol QLFT protocol uses the published saccharin test protocol because that protocol is widely accepted. Bitrex™ is routinely used as a taste aversion agent in household liquids which children should not be drinking and is endorsed by the American Medical Association, the National Safety Council, and the American Association of Poison Control Centers. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) Taste Threshold Screening

The Bitrex™ taste threshold screening, performed without wearing a respirator, is intended to determine whether the individual being tested can detect the taste of Bitrex™.

- (1) During threshold screening as well as during fit testing, subjects shall wear an enclosure about the head and shoulders that is approximately 12 inches (30.5 cm) in diameter by 14 inches (35.6 cm) tall. The front portion of the enclosure shall be clear from the respirator and allow free movement of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly, parts # FT 14 and # FT 15 combined, is adequate.
- (2) The test enclosure shall have a $\frac{3}{4}$ inch (1.9 cm) hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.
- (3) The test subject shall don the test enclosure. Throughout the threshold screening test, the test subject shall breathe through his or her slightly open mouth with tongue extended. The subject is instructed to report when he/she detects a bitter taste.
- (4) Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the test conductor shall spray the Threshold Check Solution into the enclosure. This Nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.
- (5) The Threshold Check Solution is prepared by adding 13.5 milligrams of Bitrex™ to 100 ml of 5% salt (NaCl) solution in distilled water.
- (6) To produce the aerosol, the nebulizer bulb is firmly squeezed so that the bulb collapses completely, and is then released and allowed to fully expand.
- (7) An initial ten squeezes are repeated rapidly and then the test subject is asked whether the Bitrex™ can be tasted. If the test subject reports tasting the bitter taste during the ten squeezes, the screening test is completed. The taste threshold is noted as ten regardless of the number of squeezes actually completed.

- (8) If the first response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the Bitrex™ is tasted. If the test subject reports tasting the bitter taste during the second ten squeezes, the screening test is completed. The taste threshold is noted as twenty regardless of the number of squeezes actually completed.
- (9) If the second response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the Bitrex™ is tasted. If the test subject reports tasting the bitter taste during the third set of ten squeezes, the screening test is completed. The taste threshold is noted as thirty regardless of the number of squeezes actually completed.
- (10) The test conductor will take note of the number of squeezes required to solicit a taste response.
- (11) If the Bitrex™ is not tasted after 30 squeezes (step j), the test subject is unable to taste Bitrex™ and may not perform the Bitrex™ fit test.
- (12) If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.
- (13) Correct use of the nebulizer means that approximately 1 ml of liquid is used at a time in the nebulizer body.
- (14) The nebulizer shall be thoroughly rinsed in water, shaken to dry, and refilled at least each morning and afternoon or at least every four hours.

(b) Bitrex™ Solution Aerosol Fit Test Procedure

- (1) The test subject may not eat, drink (except plain water), smoke, or chew gum for 15 minutes before the test.
- (2) The fit test uses the same enclosure as that described in 1.a and 1.b above.
- (3) The test subject shall don the enclosure while wearing the respirator selected according to Section 7.2. of this Program. The respirator shall be properly adjusted and equipped with any type particulate filter(s).
- (4) A second DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.
- (5) The fit test solution is prepared by adding 337.5 mg of Bitrex™ to 200 ml of a 5% salt (NaCl) solution in warm water.
- (6) As before, the test subject shall breathe through his or her slightly open mouth with tongue extended, and be instructed to report if he/she tastes the bitter taste of Bitrex™.
- (7) The nebulizer is inserted into the hole in the front of the enclosure and an initial concentration of the fit test solution is sprayed into the enclosure using the same number of squeezes (either 10, 20 or 30 squeezes) based on the number of squeezes required to elicit a taste response as noted during the screening test.

- (8) After generating the aerosol, the test subject shall be instructed to perform the exercises in Appendix C-1 of this Program.
- (9) Every 30 seconds the aerosol concentration shall be replenished using one half the number of squeezes used initially (e.g., 5, 10 or 15).
- (10) The test subject shall indicate to the test conductor if at any time during the fit test the taste of Bitrex™ is detected. If the test subject does not report tasting the Bitrex™, the test is passed.
- (11) If the taste of Bitrex™ is detected, the fit is deemed unsatisfactory and the test is failed. A different respirator shall be tried and the entire test procedure is repeated (taste threshold screening and fit testing).

Appendix C-5 Irritant Smoke (Stannic Chloride) Protocol

This qualitative fit test uses a person's response to the irritating chemicals released in the "smoke" produced by a stannic chloride ventilation smoke tube to detect leakage into the respirator.

General Requirements and Precautions

The respirator to be tested shall be equipped with high efficiency particulate air (HEPA) or P100 series filter(s).

Only stannic chloride smoke tubes shall be used for this protocol.

No form of test enclosure or hood for the test subject shall be used.

The smoke can be irritating to the eyes, lungs, and nasal passages. The test conductor shall take precautions to minimize the test subject's exposure to irritant smoke. Sensitivity varies, and certain individuals may respond to a greater degree to irritant smoke. Care shall be taken when performing the sensitivity screening checks that determine whether the test subject can detect irritant smoke to use only the minimum amount of smoke necessary to elicit a response from the test subject.

The fit test shall be performed in an area with adequate ventilation to prevent exposure of the person conducting the fit test or the build-up of irritant smoke in the general atmosphere.

Sensitivity Screening Check

The person to be tested must demonstrate his or her ability to detect a weak concentration of the irritant smoke.

The test operator shall break both ends of a ventilation smoke tube containing stannic chloride, and attach one end of the smoke tube to a low flow air pump set to deliver 200 milliliters per minute, or an aspirator squeeze bulb. The test operator shall cover the other end of the smoke tube with a short piece of tubing to prevent potential injury from the jagged end of the smoke tube.

The test operator shall advise the test subject that the smoke can be irritating to the eyes, lungs, and nasal passages and instruct the subject to keep his/her eyes closed while the test is performed.

The test subject shall be allowed to smell a weak concentration of the irritant smoke before the respirator is donned to become familiar with its irritating properties and to determine if he/she can detect the irritating properties of the smoke. The test operator shall carefully direct a small amount of the irritant smoke in the test subject's direction to determine that he/she can detect it.

Irritant Smoke Fit Test Procedure

The person being fit tested shall don the respirator without assistance, and perform the required user seal check(s).

The test subject shall be instructed to keep his/her eyes closed.

The test operator shall direct the stream of irritant smoke from the smoke tube toward the face seal area of the test subject, using the low flow pump or the squeeze bulb. The test operator shall begin at least 12 inches from the facepiece and move the smoke stream around the whole perimeter of the mask. The operator shall gradually make two more passes around the perimeter of the mask, moving to within six inches of the respirator.

If the person being tested has not had an involuntary response and/or detected the irritant smoke, proceed with the test exercises.

The exercises identified in Appendix C-1 of this Program shall be performed by the test subject while the respirator seal is being continually challenged by the smoke, directed around the perimeter of the respirator at a distance of six inches.

If the person being fit tested reports detecting the irritant smoke at any time, the test is failed. The person being retested must repeat the entire sensitivity check and fit test procedure.

Each test subject passing the irritant smoke test without evidence of a response (involuntary cough, irritation) shall be given a second sensitivity screening check, with the smoke from the same smoke tube used during the fit test, once the respirator has been removed, to determine whether he/she still reacts to the smoke. Failure to evoke a response shall void the fit test.

If a response is produced during this second sensitivity check, then the fit test is passed.

Appendix D Basic Respirator Training

- Respiratory Hazards

A Chemical Safety Review for Georgia Tech Respirator Users

- Allowable Levels of Exposure

- Permissible Exposure Limit (PEL)
- Legal limit, set by the Occupational Safety and Health Administration (OSHA)
- Concentration in air to which a normal person can be exposed 8 hours/day 40 hours/week for a working lifetime without experiencing any adverse effects
- Threshold Limit Value (TLV)
- Exposure limit suggested by the American Conference of Governmental Industrial Hygienists (ACGIH) – often lower than the PEL

- Allowable Levels of Exposure

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.

- 29 CFR 1910.134 (OSHA Resp. Protection Standard)

- Types of Hazards
- Asphyxiants
- Poisons
- Irritant/Corrosives (Direct Tissue Damage)
- Sensitizers
- Simple Asphyxiants
- Act by physically displacing oxygen to less than 19.5%
- Include inert gases such as N₂, He, Ar, and CO₂.
- Other non-inert materials can also displace oxygen so that they become a dual asphyxiant/poison hazard - especially solvents which typically evaporate at room temperature or lower.
- Air (Oxygen) Displacement
- Can occur when inert gases are discharged into an unventilated space.
 - storerooms, cold/warm rooms, confined spaces (pipe chase, reaction vessels), or rooms where the ventilation is insufficient to clear the air to normal gas concentrations (19.5% O₂)
 - welding in manholes
- Air (Oxygen) Displacement
- Discharge may be sudden (open or broken valve) or slow and insidious (leaky valve or equipment vented into lab instead of exhaust ventilation)
- Can occur when a solvent container is left open or spilled in a small, confined, or poorly ventilated space.
- Oxygen Starvation

- Symptoms of oxygen starvation include:
 - Confusion, disorientation, inability to complete simple tasks
 - Euphoria- inappropriate laughing or singing
 - Headache
 - Dizziness
- Formula for a Hazard
- POISON - how toxic is it?
- EXPOSURE - how often AND how long are you exposed?
 - Acute: sudden onset often short and severe
 - Chronic: continuous exposure over an extended period of time
- DOSE - amount of material (volume and concentration)

Level of Hazard = toxicity x exposure x dose

- Chemical Over Exposures
 - Being exposed to levels *above* the Threshold Limit Value for extended periods of time or repeated occurrences → lower concentrations over longer durations or higher concentrations over short durations

- Being exposed to high concentrations in confined spaces (small volume spills can be more significant here)

- Poisons
- A number of types of chemical poisons can enter the body through the lungs, mouth, and exposed skin if they are a gas, vapor, or aerosol
- A number of conditions can cause a normally non-aerosol material to become aerosolized, such as explosions or just dropping a bottle from counter height
- Poisons
- In this case, poison is a material which is harmful (toxic) and travels through the blood to an area away from the point of exposure - skin, lung, mucus membranes to a particular organ or organ system where it causes damage
- There are as many different poisons as there are chemicals
- Toxic Effects
- Things that hurt you later...
 - Birth defects
 - Affects men and women's ability to have children
 - Liver and kidney damage
 - Causes cancers
- Irritants/Corrosives
- Typically caused by irritants/corrosives which affect the tissue they come in direct contact with
FIRST
- Symptoms include:
 - redness, burning, or itching eyes or skin
 - Burning of the nose throat, coughing
 - Burning/pain in the chest and/or difficulty breathing
- Damage from Irritant/Corrosives
- Can result in swelling of the airways impacting the ability to move air
- Can extend down to the gas exchange region of the lungs impacting the ability to oxygenate the blood
- Sensitizers

- Organic substances which are of natural origin or structurally resemble natural substances
 - Capable of causing an immune (allergic) response
 - May be a skin response (rash) or asthma-like response
 - May result in allergic responses to other structurally similar materials
- Chemicals of Concern
- Corrosives
 - Acid mists
 - Chlorine
 - Ammonia
- Organic Solvents
- “Organic Solvent” - general term describing a wide variety of chemicals such as: alcohols, acetone, and aromatics (toluene, xylene)
- Affects the CNS by “slowing it down”. This is referred to as “narcotic effects”
 - This can have the effect of preventing your brain from telling your lungs to breathe
- Solvents, Other Effects
- Includes:
 - Irregular heartbeat
 - Demyelization of central and peripheral nerves
 - Liver, kidney, bone marrow damage
- Solvent Over-Exposure
- Symptoms of acute solvent over-exposure: headache, dizziness, nausea, and fatigue; can progress to sleepiness, coma, and death if the victim is not moved to fresh air.
- Chronic solvent exposure (repeated over-exposure) can lead to liver, kidney, or bone marrow damage, demyelization of the central and peripheral nerves, or de-fatting of the skin
- Many solvents are *readily absorbed* through the skin!
- Chemical Exposure?
- Rinse contaminated area with copious amounts of tepid water for 15 minutes
- Can't fit area under a sink faucet? You must use an emergency shower
 - If clothing is involved, remove it on the way to the shower
 - Shout for help
 - Remain in the shower for 15 minutes
 - Get someone to call GT Police
 - Have street address of where you're located
 - Have your helper print 3 copies of MSDS

1) hospital 2) ambulance crew 3) GT Police/EHS

- Do not re-don contaminated clothing
- Chemical Exposure
- If you are splashed in the eyes:
 - Shout for help
 - Hold eyelids open with fingers as you rinse your eyes for a *full* 15 minutes (move eyes up and down and side to side to fully remove chemical)
 - ALL MEDICAL EXPOSURES TO THE EYES REQUIRE MEDICAL FOLLOW UP
 - EHS recommends you go to Grady Memorial Hospital to ensure proper care
- If inhaled or swallowed, see medical attention immediately
- Questions??
- A Chemical Safety Review for Georgia Tech Respirator Users
- Asbestos

- Health Effects of Asbestos Exposure
 - Asbestosis: disease caused by fibrotic scarring of the lung
 - Scarring occurs in the alveoli, causing shortness of breath because of decreased O₂ uptake
 - Clear dose-response relationship
 - Lung Cancer: most common health effect caused by asbestos exposure
 - Smoking and Lung Cancer – A cigarette smoker who also works with asbestos is *more than 50x* more likely to contract lung cancer than the normal population
- Asbestos
- Health Effects of Asbestos Exposure
 - Mesothelioma: rapidly spreading cancer of the chest or abdominal cavity lining
 - Most deadly disease associated with asbestos exposure
 - Always fatal; no known cure

No clear dose-response relationship between asbestos exposure and mesothelioma

Oil-based Paints

- Solids of oil-based paint are suspended by organic solvents
 - Mineral spirits (naphtha), toluene, xylene, and other petroleum distillate solvents
 - Can be irritating to eyes and skin
 - Inhaling fumes can cause headache, nausea, dizziness, and fatigue
 - Symptoms tend to subside once moved to fresh air
 - Chronic exposure may cause kidney, liver, or blood effects
 - Use with adequate ventilation – up to 48 hours
- Welding Fumes
- What are welding fumes?
 - Small, solid particles released into the air (plume) from base metal, base metal coating, and any intermediate filler used and the gases formed during the welding process
 - Most common: aluminum, beryllium, cadmium oxides, chromium, copper, iron oxides, lead, molybdenum, nickel, zinc oxides, fluorides, manganese, vanadium
- Welding Fumes Health Effects
- Metal fume fever: flu-like symptoms → fever, chills, nausea, headache, fatigue, muscle aches
- Burning sensation in the body
- Decreased urine output
- Shortness of breath/tightness of the chest
- Yellowing of the eyes/skin
- Vomiting and watery/bloody diarrhea
- Manganese Poisoning/“Welder’s Disease” caused by high levels of exposure to manganese welding fumes/dust. Causes:
- Irreversible damage to brain and CNS
- Dry throat/cough
- Shortness of breath
- Fatigue, fever, insomnia, mental confusion
- Welding Fumes Protection
- Adequate ventilation
- Fans can be used to blow fumes away from welders
- Avoid standing directly in or near fume plume and work upwind to reduce exposure (welders and non-welders)

- Welders should position themselves so that fumes and dust particles do not accumulate inside face shields
- Allergens
- Nuisance dust (i.e. cutting, grinding, machining, polishing, sanding), pollen, fiberglass fibers, mold spores, etc.
- Symptoms: sneezing, itching, breathing difficulties, watery eyes and nose; hay fever and asthma
- Maintain adequate ventilation and housekeeping to remove unwanted dust and reduce concentrations
- Use wet operations when possible to reduce airborne dust concentrations
- Pesticides: Fertilizers, Herbicides, and Fungicides
- Liquids/solids (powder or granules)
- Toxic/corrosive/combustible
- Slight to moderate irritation to skin (redness, rash on exposed skin areas); bronchial irritation if inhaled; causes moderate to severe eye/corneal damage
- Harmful if absorbed through skin
- Examples: Basagran T/O, Primo Ciba, Daconil 2787, 12-0-0 Chelated Iron fertilizer
- Hydrogen Sulfide (H₂S)
 - Flammable gas
 - Skin
 - Rotten Egg Odor
 - Sense of smell becomes rapidly fatigued and cannot be relied upon (3-100ppm)
 - Is a blood & cellular level asphyxiant
 - IDLH = 100 ppm, TLV= 10ppm, STEL = 15ppm
 - Symptoms- eye irritation (70ppm), apnea, pulmonary edema (250ppm), convulsions, brain damage. High doses result in respiratory paralysis

- Hydrogen Fluoride

Hydrogen Fluoride/Hydrofluoric Acid

- Extremely corrosive/toxic/corrosive
- Colorless gas/fuming liquid
- Skin (burns)/inhalation
- TLV=3 ppm STEL=3ppm
- IDLH=30 ppm
- Symptoms: Irritation to eyes, skin, nose, throat, pulmonary edema, burns, bone damage
- Aziridine

Aziridine aka ethyleneimine

- Highly Flammable/Toxic
- Clear oily liquid/ammonia-like odor
- Inhalation/Rapidly penetrates skin on contact
- TLV=0.05 ppm STEL=0.1ppm
- IDLH= 100 ppm
- Symptoms: HDN, irritation to eyes, nose, resp. tract, and skin (burns); pulmonary edema
- Possible carcinogen

- Mercury Vapor

- TLV=0.025 mg/m³= 0.003ppm
- IDLH= 2 mg/m³= 0.24 ppm
- Skin
- Eye irritant, cough, chest pain, dyspnea, tremor, damage to CNS, kidneys

Basic Respirator Care and Use

- This training material must be supplemented with hazard information specific to the chemical and process which makes respirator use necessary...
- Why is respirator use necessary?

Certain tasks within your job have been identified as having a potential for exposure to respiratory hazards

- What should have already happened...
- EHS has determined...
 - That a respirator is necessary for your particular task
 - general knowledge of your process
 - air monitoring, and/or
 - watching you work
 - what kind of respirator and cartridges are appropriate for your particular task
- Sound familiar?!
 - Medical clearance - this means that a qualified health care professional has determined that wearing a respirator will not injure you
 - Fit-testing – this means that you have been fit-tested in the *same make, model, and size* respirator you will be using
- Fit Testing

Quantitative (QNFT)

- Uses a device that measures a test contaminant outside and inside the mask
- Produces a numeric “score” that indicates how well the respirator fits you
- For some respirators it allows you to use the mask at higher contaminant concentrations than a QLFT
- More About Fit Testing...
- Fit testing must be re-accomplished every year and/or whenever there has been a change that can affect the fit (i.e. weight gain or loss, facial scarring, dental appliances)
- Training Overview
 - Types of respirators and their limitations
 - APR respirator cartridge selection, installation, and change out schedules
 - How to inspect, don, adjust, and remove the respirator
 - How to perform positive and negative pressure seal checks
 - How to clean, repair, and store your respirator



Types of Respirators and their Limitations

- Air Purifying Respirators
- Air Purifying Respirators (APR) also known as cartridge respirators and gas masks
 - May be half-face or full-face
 - Negative pressure
 - Negative pressure respirators rely on lung capacity to move air through the filters
 - Relies on keeping track of how “full” the cartridges are - by watching for a color change, or by knowing how many hours the cartridges have been in service
- Negative Pressure APRs
- A Good Seal is *very* important!
 - Inhaling causes a drop in air pressure inside the mask - a prime opportunity for the contaminant to seep into your respirator - if the seal is not adequate
- APR Limitations
(what this mask will not protect you against!)
 - Oxygen deficient - less than 19.5% O₂
 - Contaminant concentrations in the IDLH range
 - Unknown atmospheres=unknown contaminant and/or unknown concentrations
 - Contaminants with poor warning characteristics- no odor, no taste - the only way you know that your seal has failed is when you taste or smell the contaminant
 - Contaminants that are so highly toxic or carcinogenic that only the most protective respirators are allowed (SCBA/SAR)
 - Positive Pressure APRs
 - May be tight-fitting or loose-fitting hood styles
 - Limitations-
 - Will not protect against oxygen deficient atmospheres (<19.5%)
 - Cannot be used in IDLH or unknown atmospheres
- Self Contained Breathing Apparatus
- Pressure demand-
 - Air enters mask only by negative pressure caused by inhalation
 - System triggered to give MORE air by inhalation
- Limitations-
 - Subject to leakage inward, due to pressure drop
 - Heavy & time limited- sometimes only a few minutes depending on level of activity
- APR Cartridge selection and change out schedules
- Selection is based on contaminant - One size DOES NOT FIT all!
- Only EHS can determine which cartridge you should be using
- Types of Cartridges
- Chemical cartridge - media reacts with and traps contaminants
- Filter - traps and stops particulates. Filters are designated according to their resistance to oil and their efficiency:
 - N is not resistant to oil
 - R is resistant to oil
 - P is oil-proof
 - Efficiencies are 95, 97 and 99.9% (usually written as 100%)
- Cartridge Change out Schedules
- Some cartridges change color when they need to be changed (End of Service Life Indicator or ESLI)

- Others rely on schedules published by the manufacturer, based on usage and concentration of the contaminant
- Keeping Track of Your Cartridges
- The change out schedule for the chemical cartridge you will be using:
- Lab Personnel:
 - Change every 4 hours (especially using solvents) or more often if you feel necessary
- EH&S:
 - N95s and 3M Pancake filters: toss after each use
 - P100 Particulate filters: wipe off between uses; toss when you experience difficulty breathing
- Inspecting Your Respirator
- Inspect the respirator before each use and when cleaning it:
 - Inspect harness/elastic parts – are they in good condition?
 - Seal is in good condition and clean
 - Visually inspect all valves and o rings
 - Make sure that they are there
 - Make sure that they have not lost their proper shape
 - Remove valves and inspect visually, if needed
- Donning, Adjusting, and Doffing Your Respirator

This procedure is model specific...

- Holding respirator with one hand, place chin inside chin cup and top of respirator over nose
- Using other hand, position plastic straps to center of head
- Fasten elastic straps behind neck and under hair
- Tighten straps evenly on both sides until respirator is snug and centered on face
- Never over-tighten! The respirator should not hurt you
- Remove by loosening straps
- A good seal is not just the most important thing- it's the only thing!
- Nothing that can interfere with the seal is allowed, this includes...
- jewelry, eyeglasses, hair
 - Mutton chops
 - Goatees
 - Beards
 - Day old stubble
- Other Considerations
- Because dentures can affect the shape of your face (and the fit of your respirator), if you are fit-tested with your dentures in place, you must wear the dentures when you wear the respirator
- If you are going to wear safety glasses and/or prescription glasses with your ½ face mask, you must wear them during fit-testing
- Seal checks must be performed *every* time the respirator is donned
- - Positive Pressure Seal Check
 - Close off the exhalation valve and exhale gently into the facepiece
 - The face fit is considered satisfactory if a slight positive pressure can be built inside the facepiece without any evidence of outward leakage of air at the seal
 - Negative Pressure Seal Check
 - Close off the inlet opening of the cartridges by covering them with the palm of the hand (depending on the cartridge)

- Inhale gently so that the facepiece collapses slightly; hold for ten seconds
- If the facepiece remains in its slightly collapsed condition, and no inward leakage of air is detected, the tightness of the respirator is deemed satisfactory

- One more thing...
 - The design of the inlet opening of some cartridges cannot be effectively covered with the hands. The test can be performed by covering the inlet opening with a thin latex glove
- Cleaning and Repairing Your Respirator
- Your respirator should be cleaned with sanitizing wipes or in *warm* water (never hot) with mild detergent and a cloth or soft brush
- Air dry your respirator in an *uncontaminated* environment at room temperature (never use hot air, such as from a hair dryer or wall heater, as it may damage the respirator)
- Clean the seat of the exhalation valve carefully- you may want to remove it completely. Allow the parts to dry before reassembling
- Cleaning and Repairing Your Respirator
- Make sure that the face seal is well cleaned
- Inspect your respirator as you clean it
- Respirator repairs, which can be done by unsupervised Georgia Tech personnel, are limited to changing out inhalation and exhalation valves and head strap components
- Lenses can be replaced, but only in the presence of an EHS staff member, as the mask must be fit-tested to check for leaks afterwards
- Storing Your Respirator
- Store your respirator in a plastic bag so as to keep the facepiece from being distorted (in other words don't throw your respirator into the bottom of your tool box)
- Remember, whatever contaminates your respirator, you wear and breathe as soon as you put it on
- Next Year...
- Medical Clearance,* fit-testing, and training (must be re-accomplished every year)
- Now, we have a test!

*More than just a questionnaire may be required if you are over 40, have medical problems, or are exposed to specific hazards, such as asbestos

- Questions??

Basic Respirator Care and Use

