

OCCUPATIONAL RESPIRATORY PROTECTION

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AGENDA

DAY 1

8:30	Introduction	30 minutes
9:00	Quiz	15 minutes
9:15	Discussion/Objectives	15 minutes
9:30	Class Brainstorming session	5 minutes
9:35	Units/Terms/Definitions	40 minutes
10:15	Break	15 minutes
10:30	Contaminants/Routes of Entry	30 minutes
11:00	Respiratory Anatomy and Physiology	35 minutes
11:30	Types of Respirators	40 minutes
12:00	Lunch	1 hour
1:00	Regulations and Guidelines	90 minutes
2:30	Break	15 minutes
2:45	Inspection/Cleaning/Storage	75 minutes
4:30	DISMISS	

DAY 2

8:30	Review	30 minutes
9:00	Medical Surveillance/Clearances/Requirements	30 minutes
9:30	Uses and Limitations of Respirators	30 minutes
10:00	Selection of Respirators	30 minutes
10:30	Break	15 minutes
10:45	Qualitative/Quantitative Fit Test	90 minutes

AGENDA - Continued

12:15	Lunch	1 hour
1:15	Facial Hair Discussion/Portacount	30 minutes
1:45	Respiratory Protection Program/SOPs	1 hour
2:45	Break	15 minutes
3:00	Cost of an Effective Program	30 minutes
3:30	Case Studies/Selection Exercises	75 minutes
4:30	Dismiss	

DAY 3

8:30	Review	30 minutes
9:00	Case Studies/Selection Exercises	90 minutes
10:30	Break	15 minutes
10:45	Quiz	30 minutes
11:15	Discussion/Evaluation	30 minutes
12:00	DISMISS	

OCCUPATIONAL RESPIRATORY PROTECTION COURSE OBJECTIVES

PARTICIPANTS WILL

- Learn to use and understand commonly encountered respiratory protection terminology
- Learn the basic anatomy and physiology of the human pulmonary system
- Understand the limitations of respiratory protection equipment
- Learn how to select appropriate respiratory protection based on hazards
- Learn to recognize commonly encountered air contaminants
- Learn important elements in the design and maintenance of an effective respiratory protection program
- Learn to clean, store, and maintain respirators
- Be introduced to qualitative and quantitative fit test procedures
- Learn recommended program guidelines in addition to the appropriate legal requirements governing respiratory protection

Respiratory Protection

Follow-up Activities

- Wrote or revised our respiratory protection program.
- Developed appropriate respirator selection procedures based on our specific hazards.
- Conducted respirator safety training, utilizing materials provided in the Respiratory Protection manual.
- Conducted a program audit.
- Developed or revised fit testing procedures.
- Wrote or revised cleaning and/or storage procedures for respirators used at our facility.
- Conducted a hazard assessment to determine need for respirators
- Issued Appendix D to voluntary users

Activity Plan

	Activity	Other people involved	Target Deadline
<input type="checkbox"/>			

Resources Available from the Division of Safety & Hygiene (DSH) Libraries

(800) 644-6292 (614) 466-7388

library@bwc.state.oh.us

www.ohiobwc.com

Safety training:

- Safety talks, outlines and scripts - DSH Safety leader's discussion guide, Training Center's One-hour safety presentations, reference books, web resources
- Videos – hundreds of safety and health topics
- Books and articles on training techniques

Machine and equipment safety:

- Safety standards (ANSI, NFPA, CGA)
- Books and articles on power presses, material handling equipment, lockout/tagout, etc.

Sample written programs:

- DSH program profiles and sample written programs
- Reference books
- Internet resources

Illness and injury statistics:

- Statistics from the U.S. Bureau of Labor Statistics
- National Safety Council's *Injury Facts*
- National Institute of Occupational Safety & Health (NIOSH) studies

Hazard communication and chemical safety:

- Chemical safety information
- Material safety data sheets (MSDSs)
- Sample written programs
- Videos
- Internet resources

Safety standards

- American National Standards Institute (ANSI) standards (including standards for construction, machinery and equipment, personal protective equipment)
- National Fire Protection Association (NFPA) fire codes (including the Life Safety Code and the National Electrical Code)
- Compressed Gas Association (CGA) standards

Other topics of interest (books, articles, magazines, videos and standards):

- Confined spaces
- Electrical safety
- Job safety analysis
- New employee orientation
- Powered industrial trucks
- Respiratory protection
- Safety culture
- Scaffolds

Directories and lists of vendors of safety equipment

Occupational Safety & Health Administration (OSHA) regulations

Manual of Uniform Traffic Control Devices (MUTCD)

Recommendations of useful Internet sites

BWC publications

**INTERNET WEB SITES
FOR
OCCUPATIONAL SAFETY & HEALTH INFORMATION
April 2005**

GENERAL

NATIONAL SAFETY COUNCIL (NSC)

<http://www.nsc.org/>

The NSC has a user friendly web site for innovative and current information on home, farm and community, on the road and workplace safety and as well statistical data and charts.

NORTH DAKOTA WORKFORCE SAFETY & INSURANCE

<http://www.workforcesafety.com/>

For workplace safety, North Dakota's WSI site puts forth their "safe operating procedures" page where they give information on accident and near miss reports, substance abuse, material handling and storage, walking and working surfaces, and safety program development and orientation.

OCCUPATIONAL & INDUSTRIAL SAFETY RESOURCES

<http://www.khake.com/page59.html>

Maintained by a Vocational Information Center, this web site provides links to occupational and industrial safety with lists of directories, national centers, hotlines and help lines as well as specific area coverage such as emergency, disaster and natural hazards, and tool, machine and equipment safety options.

OKLAHOMA STATE UNIVERSITY

<http://www.pp.okstate.edu/ehs/>

The Department of Environmental Health & Safety at OSU offers an online safety resource library that is constantly being updated with topics from A-Z including specific areas of safety such as fire, construction, HAZCOM and training. Go to the "Links Library" option.

SAFETY DIRECTORY

<http://www.safetydirectory.com/>

Safety Directory.com is an Internet gateway to occupational health & safety sites. This web site is indexed with information on industry specific topics, training, illness and injury, as well as safety publications and resources.

FEDERAL GOVERNMENT

CENTERS FOR DISEASE CONTROL & PREVENTION (CDC)

<http://www.cdc.gov/>

The CDC is always a good resource for current medical issues throughout the United States. Health topics from A-Z give an in-depth look at most communicable diseases as well as topics such as safe driving, violence, and air pollution, and workplace safety and health topics.

FEDERAL EMERGENCY MANAGEMENT ASSOCIATION (FEMA)

<http://www.fema.gov/>

For up-to-date information on active disasters and emergencies nationwide access this web site first. Publications include options for emergency preparedness and prevention, response and recovery, disaster fact sheets, and public awareness information.

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY & HEALTH (NIOSH)

<http://www.cdc.gov/niosh/homepage.html>

NIOSH's web site provides current information on many services as well as safety research, including ergonomics programs, respirators, and mining safety. At the chemical page you will find databases and other helpful resources, information on personal protective equipment, as well as government agency web sites of interest.

OCCUPATIONAL SAFETY & HEALTH ADMINISTRATION (OSHA)

<http://www.osha.gov>

OSHA'S official web site includes media releases, online publications, statistics, standards & directives, "Technical Links," training center courses, "hot topics," and "what's new" as well a very useful A-Z index page.

INTERNATIONAL RESOURCES

HEALTH & SAFETY EXECUTIVE (HSE)

<http://www.hse.gov.uk/>

The United Kingdom has an international safety web site with a good deal to offer on occupational safety & health. Drop down boxes offer A-Z industry information, health and safety topics, tools, research, as well as publications and statistics.

ERGNET

<http://www.sunderland.ac.uk/~ts0qli/ergnet.htm>

The University of Sunderland in the UK is an international web site directory of "places for ergonomics and human factors". Featuring lists of sources such as societies, organizations, government bodies, institutes, centers and laboratories, this site also gives links to journals, a research database and other general ergonomic sites.

OHIO

OHIO EPA (OEPA)

<http://www.epa.state.oh.us>

At the official web site for Ohio's Environmental Protection Agency; use the "Topic Index" to find regulations and information on permits, hazardous waste, pollution prevention, wastewater, wetlands, and much more.

OHIO STATE LIBRARY/OHIOLINK

<http://winslo.state.oh.us>

At **OhioLink**, a statewide library and information network, you can search the State Library of Ohio's collection for the BWC's Division of Safety & Hygiene library books as well as other Ohio College and university library collections. Also available at this web site are searchable versions of Ohio Administrative laws and rules, electronic databases, and other Ohio library directories.

SPECIFIC (BY SUBJECT)

CONSTRUCTION

<http://www.cdc.gov/elcosh/index.html>

CDC's **eLCOSH** is a comprehensive library of construction-related safety information presented in both English and Spanish with items listed under trade, hazard, job site, and others. Also see: The Construction Industry Safety Council, a Center to Protect Workers' Rights resource center at <http://www.buildsafe.org/RSC.htm> for OSHA publications in PDF and hazard alerts.

ERGONOMICS

<http://www.ergoweb.com>

ERGOWEB provides current information on ergonomics and human factor science. Offered are: research, case studies, reference material and a forum for questions, answers and discussion.

LABORATORY SAFETY

<http://safety.science.tamu.edu/>

Texas A&M University College of Science is an optional choice for safety in the laboratory information. From hazard identification to waste disposal this web site offers thorough coverage of laboratory safe practices.

MATERIAL SAFETY SHEETS

<http://www.ilpi.com/msds/index.html>

This web site offers many solutions for finding MSDS (100 free sites) as well as chemical manufacturers and suppliers, pesticides including fertilizers, government sites, and other miscellaneous locations for chemical data. Also check any toxicological effects at <http://www.atsdr.cdc.gov/toxprofiles/> and health and safety information on household chemical ingredients at <http://householdproducts.nlm.nih.gov/>.

MOTOR CARRIER SAFETY PROGRAMS

<http://www.fmcsa.dot.gov/safetyprogs/saftprogs.htm>

The Federal Motor Carrier Safety Administration (FMCSA), an administration within the U.S. Department of Transportation, regulates and supports the Nation's interstate commercial carrier industry. The FMCSA web page offers several safety programs in PDF format such as brake safety, fatigue, HAZMAT safety, speed management, sharing the road safely, and other insurance and licensing information.

RADIATION

<http://www.physics.isu.edu/radinf/>

The Radiation Information Network offers a web site that is in-depth with information on radiation topics and issues. In addition to what's new in the field and general information there are regulatory, organizational and society links as well as research and educational resources available to access.

SAFETY STATISTICS

<http://stats.bls.gov/>

Occupational health and safety statistics by industry and occupation can be researched for injuries, illnesses, and fatality data at this web site starting with the "Overview of BLS Statistics on Worker Safety and Health" page.

SAFETY BRIEFINGS, MANUALS, PRODUCTS & PROGRAMS

OSHA POWERPOINT SAFETY PRESENTATIONS

<http://esf.uvm.edu/sirippt/powerpt.html>

An extensive safety PowerPoint presentation library is available at this web site featuring A-Z topics such as accident investigations, bomb threats, chemical spills, construction, electrical, hand tools, emergency response, fire safety, forklifts, JSA, laser, OSHA compliance, PPE, razor knife safety, safe lifting, and many more.

SAFETY PUBLICATIONS & VIDEO RESOURCES

<http://www.cbs.state.or.us/external/osha/standards/pub.htm>

A valuable resource for safety resources, the Oregon State's Department of Consumer and Business Publications web site is packed with downloadable information. Areas covered are agriculture, asbestos abatement, occupational exposures, HAZCOM, HAZMAT, HAZWOPER, safety practices, writing manuals and programs, tools of the trade, workers' compensation and ergonomics.

Ohio Bureau of Workers' Compensation, Div. of Safety & Hygiene Library
 30 W. Spring St., L-3, Columbus, OH 43215-2256
 (800) 644-6292, press option 2 - 2
 (614) 466-7388/ (614) 644-9634 (fax)
 E-Mail: library@bwc.state.oh.us

Saving You Time and Research

Requests for copies of OSHA standards, information on starting a safety committee, a video on accident investigation techniques -- these are some of the thousands of inquiries BWC's Division of Safety & Hygiene (DSH) libraries receive each year.

DSH has two libraries to serve you:

- The central library in the William Green Building in downtown Columbus;
- The resource center and video library located at the Ohio Center for Occupational Safety and Health (OCOSH) in Pickerington.

Both libraries are open 8 a.m. to 4:45 p.m., Monday through Friday. Your need for information does not require a visit to the library. You can phone, fax, or e-mail your requests and receive a quick response.

The central library provides free information services on the topics of occupational safety and health, workers' compensation and rehabilitation.

The OCOSH resource center provides similar services for those who visit OCOSH for meetings and training center classes.

Students from the DSH training center can use the services and collections of the libraries to assist with the completion of their course **follow-up activities**. The librarians have recommended a variety of resources for the follow-up activities and are available to answer questions and provide assistance.

The video library offers an extensive collection of videotapes to supplement your organization's safety and health training program. It is a convenient and popular source for Ohio employers to borrow quality occupational safety- and health-related training aids.

Visit our Web site at **www.ohiobwc.com**.

Central library
30 W. Spring St., Third Floor
Columbus OH 43215-2256
1-800-OHIOBWC
(614) 466-7388
(614) 644-9634 (fax)
library@bwc.state.oh.us

OCOSH resource center
13430 Yarmouth Drive
Pickerington OH 43147
1-800-OHIOBWC
Resource center (614) 728-6464
Video library (614) 644-0018

BASIC RESPIRATORY PROTECTION QUIZ
OHIO CENTER FOR OCCUPATIONAL SAFETY AND HEALTH

Name: _____

1. Survivair brand organic vapor cartridges can be used on an MSA Inc. respirator.
True or False
 2. OSHA approves all respirators. True or False
 3. A full-face air purifying respirator can be used for work in an immediately dangerous to life or health (IDLH) concentration of toluene. True or False
 4. What is the NIOSH assigned protection factor (APF) for a reusable half-mask respirator?
 - _____ a. 1
 - _____ b. 5
 - _____ c. 10
 - _____ d. 100
 - _____ e. 150
 5. What is the formula to calculate the fit factor (FF) of a respirator?
 6. One size respirator will fit all workers. True or False
 7. The maximum use concentration (MUC) of a respirator is determined by:
 - _____ a. measuring the amount of chemical necessary to cause an employee to pass out and then divide by 100
 - _____ b. $TLV \div PEL$
 - _____ c. $PEL \div TLV$
 - _____ d. $exposure\ limit \times APF\ of\ the\ respirator$
 - _____ e. $APF \times IDLH\ concentration$
 8. The hose couplings for supplied air respirators must be:
 - _____ a. compatible with the plant's compressed air line fittings
 - _____ b. a universal-type for ease of use
 - _____ c. female type
 - _____ d. incompatible with outlets for non-respirable worksite air
 9. Respirator approval is based on the entire respirator unit. True or False
-

10. Calculate the FF of a respirator given the concentration of the test atmosphere outside the respirator is 153 and the concentration inside the respirator is 3.
11. Your company has a process which uses inorganic lead. Extensive air sampling data indicate lead exposures 4 to 6 times the OSHA PEL and oil aerosols are not present. Which one of the following respirators is the minimum you can use for this operation? (Assume engineering controls are in place and are properly working and administrative controls are not feasible.)
- a. supplied air full-facepiece demand mode, with SCBA escape
 - b. supplied air half-mask, demand mode
 - c. reusable air purifying half-mask with N95 filter rating
 - d. reusable air purifying full-facepiece with an N99 filter rating
 - e. reusable air purifying half-mask with an N100 filter rating
12. Qualitative or quantitative fit testing must be performed when respirator use is voluntary. True or False
13. According to the OSHA respiratory protection standard, engineering controls are to be used only if they cost 5 times more than a respirator program. True or False
14. When using air purifying respirators for gases and vapors you must develop change schedules for the cartridges or canisters if certified End of Service Life Indicators (ESLI) are not available for the contaminant of concern. True or False
15. Medical evaluations for employees required to wear respirators must be performed annually? True or False
16. What is the lowest level (percent) of oxygen into which an air purifying respirator can be worn?
- a. 23 %
 - b. 21 %
 - c. 19.5 %
 - d. 18.2 %
 - e. 16 %
17. Fit Factor (FF) is the same as the Assigned Protection Factor (APF). True or False
18. Facial hair is allowed if it does not interfere with the face to facepiece seal or valve function. True or False.

WARNING

IMPROPER USE OF A RESPIRATOR MAY RESULT IN PERSONAL INJURY OR DEATH. IMPROPER USE INCLUDES, BUT IS NOT LIMITED TO, USE WITHOUT ADEQUATE TRAINING, DISREGARD OF THE WARNINGS AND INSTRUCTIONS, AND FAILURE TO INSPECT AND MAINTAIN THE RESPIRATOR.

RESPIRATORS ARE INTENDED TO BE USED ONLY IN CONJUNCTION WITH AN ORGANIZED RESPIRATORY PROTECTION PROGRAM WHICH COMPLIES WITH THE REQUIREMENTS OF "PRACTICES FOR RESPIRATORY PROTECTION", Z88.2-1980 AVAILABLE FROM AMERICAN NATIONAL STANDARDS INSTITUTE INC., 1430 BROADWAY, NEW YORK, N.Y. 10018 OR THE REQUIREMENTS OF OSHA SAFETY AND HEALTH STANDARD 29 CFR 1910 PARAGRAPH 134 AVAILABLE FROM THE U.S. DEPARTMENT OF LABOR, OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION, OR OTHER PERTINENT NATIONALLY RECOGNIZED STANDARDS, SUCH AS THOSE PROMULGATED BY THE U.S. COAST GUARD OR THE DEPARTMENT OF DEFENSE.

THESE RESPIRATORS ARE NOT INTENDED FOR USE IN ATMOSPHERES WHICH ARE, OR MAY BECOME, IMMEDIATELY DANGEROUS TO LIFE OR HEALTH (IDLH) OR IN ATMOSPHERES WHERE THE IDENTITY AND/OR CONCENTRATION OF THE CONTAMINANT IS UNKNOWN.

Patent Applied For.

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IH CONTROL CATEGORIES

ENGINEERING

- Local Exhaust Ventilation
- General or Dilution Ventilation
- Substitution
- Isolate or Enclose
- New or Modified Process
- Good Housekeeping

ADMINISTRATIVE

- Rotation of Workers
- Non-routine Work Done on an Off Shift
- Contract the Work Out
- Continuous Monitoring
- Medical Monitoring
- Educational programs

PERSONAL PROTECTIVE EQUIPMENT

- Skin Protection (gloves including whole body encapsulation)
- Hearing Protection
- Respiratory Protection

DRAWBACKS TO PPE

1. Burden of protection placed on employees
2. Must be properly fitted
3. Must be properly maintained and cleaned
4. Uncomfortable
5. False sense of security

TYPES OF HAZARDS

- **Chemical (including gases and particulates)**
 - ⇒ Toxic
 - ⇒ Explosive
 - ⇒ Oxidizers
 - ⇒ Flammables
 - ⇒ Corrosives
 - **Biological**
 - ⇒ Viruses
 - ⇒ Bacteria
 - ⇒ Fungus
 - ⇒ Other living organisms (plants, parasites, etc.)
 - ⇒ Pieces of any of the above
 - **Physical**
 - ⇒ Noise
 - ⇒ Temperature extremes
 - ⇒ Radiation
 - ⇒ Ergonomic
-

FORMS OF CONTAMINANTS

Gas - a state of matter which (at standard temperature and pressure (25° C and 760 mm mercury)) has very low density and expands or contracts to occupy the space of enclosure in which it is confined relative to changes in temperature and/or pressure

Vapor - An air dispersion of molecules of substances which is a solid or liquid in its normal state. Evaporation is the process by which a liquid is changed into the vapor state. Solvents with low boiling points will evaporate readily. Water vapor, solvent vapors...

Dust - Solid particles generated by handling, crushing, grinding, rapid impact, detonation, or decrepitation (breaking apart by heating) of materials such as rock, ore, metal, coal, wood, and grain. Dusts do not tend to flocculate, except under electrostatic forces; they do not diffuse in air but settle under the influence of gravity. They range in size for 0.1 to 25 micrometers (also called microns and each micron is one-one millionth of a meter) in diameter. A person with normal eyesight can see dust particles as small as 50 microns. Dusts are physically divided into two categories: total and respirable. Total dust particles include the entire range of dust particle sizes. Respirable particulates nominally range in size from 1 to 10 microns.

Fume - an aerosol which is formed when the material from a volatilized solid condenses in air. Two of the most commonly encountered fumes are metal and polymer fumes. Fume particle sizes are generally less than 1 micron in diameter.

Mist - an aerosol of liquid droplets suspended in air, usually generated by the breaking up of a liquid by splashing, atomizing, or forming. Examples include oil/coolant mists, acid mists.

Fibers - solid particles which are longer than 5 microns and have a length to diameter ratio of 3 to 1 or greater. Examples include asbestos, glass fibers, ceramic fibers, carbon fibers.

Smoke - an aerosol of carbonaceous particles, generally the result of incomplete combustion of carbon containing materials. Examples: coal smoke, oil smoke, tobacco smoke...

Fog - a visible aerosol of a liquid formed by the condensation, as opposed to agitation, of a vapor. Examples: heated vapor degreasers, atmospheric fog, smog.

UNITS OF MEASURE

- Parts per million (ppm)

$$\text{ppm} = 10^6 \times \frac{\text{volume of contaminant}}{\text{total volume}}$$

** usually used when measuring gases or vapors*

- Milligrams per cubic meter (mg/m³)

$$\text{mg/m}^3 = \frac{\text{milligrams of contaminant}}{\text{cubic meter of air}}$$

** usually used when measuring particulates*

- Micrograms per cubic meter (µg/m³)

$$\mu\text{g/m}^3 = \frac{\text{micrograms of contaminant}}{\text{cubic meter of air}}$$

micron – one millionth of a meter

- about 1 thousandth the diameter of a human hair

- Fibers per cubic centimeter (f/cc)
- Millions of particles per cubic foot (MPPCF)

Conversion

- mg/m³ to ppm $\text{ppm} = \frac{24.45 \times \text{mg/m}^3}{\text{molecular weight of contaminant}}$

- ppm to mg/m³ $\text{mg/m}^3 = \frac{\text{molecular weight of contaminant} \times \text{ppm}}{24.45}$

EXPOSURE

- Exposure - external human contact or interaction with a chemical, physical, or biological agent. Exposure is measured by industrial hygiene monitoring.
- Dose - the amount of an agent absorbed or present within an organism.
- Effective Exposure - the amount of a physical, chemical, or biological agent accumulated at a target site within an organism which could result in an adverse effect.

ROUTES OF ENTRY

- Inhalation - gases or particles can enter the body via the pulmonary system. Contaminants can either react with the pulmonary system itself or enter the bloodstream.
 - Most common industrial exposure
 - Solubility of contaminant is important determinant of where a contaminant will react
- Absorption - liquids and some gases can enter the bloodstream through the skin and/or eyes.
 - lipophilic (non-polar) are most likely to pass through skin
 - acids and alkalis interact with skin and produce toxic effect
- Ingestion - contaminants can enter the body via the gastrointestinal system
 - eating without washing hands
 - smoking without washing hands
 - contaminated food
- Injection - contaminants can enter the body on sharp objects piercing the skin
 - inadvertent sharp pokes (hospitals)
 - lacerations by contaminated objects
 - air compressors - dust

TOXICITY

- “What is it that is not poison? All things are poison and nothing is without poison. It is the dose only that makes a thing not a poison.” Paracelsus
- Toxicity vs Hazard
 - Toxic - the ability of a substance to produce an unwanted effect when the substance has reached a sufficient concentration at a certain site in the body.
 - Hazard - the probability that a substance will cause injury in a given environment or situation.

DEGREE OF RISK

- Frequency
- Intensity
- Duration
- Individual Sensitivity
- Toxicity of the Chemical

ACUTE vs. CHRONIC (Effects and Exposures)

- Acute – higher exposures over a short period of time
 - sudden onset
 - short duration
 - reversible
 - irritation, narcotic, simple asphyxiants
 - immediate transient alteration of cellular and organ response
- Chronic – persistent, prolonged, repeated
 - insidious onset
 - long duration
 - irreversible
 - carcinogenesis, pneumoconiosis
 - continuous alteration of cellular and organ response
- Local
 - manifestation of effects at the site of contact between compound and organism
 - inflammation
 - chemical burns
 - silicosis, asbestosis
- Systemic Effects
 - manifestation of effects at a target site or organ following absorption and distribution of compound within an organism
 - hepatitis, carcinomas

APPLICABLE ORGANIZATIONS

OSHA - the Occupational Safety and Health Administration was created in 1970 by the Williams-Steiger Occupational Safety and Health Act of 1970 (PL 91-496). OSHA officially came into existence in April, 1971. The Occupational Safety and Health Act grants the Secretary of Labor the authority, among other things, to promulgate, modify, and revoke safety and health standards, to conduct inspections and investigations, to issue citations including proposed penalties, to require employers to keep records of safety and health data, to petition the courts to restrain imminent danger situations, and to approve or reject state plans for the program under the Act.

NIOSH - the National Institute for Occupational Safety and Health was established within the Department of Health, Education, and Welfare by the Occupational Safety and Health Act of 1970 to conduct research and to recommend new occupational safety and health standards. These recommendations are transmitted to the Department of Labor, which has responsibility for the final setting, promulgation, and enforcement of the standards.

ACGIH - the American Conference of Governmental Industrial Hygienists was founded in 1938 by a group of governmental industrial hygienists who desired a medium for the free exchange of ideas and experiences and the promotion of standards and techniques in industrial health. Membership is limited to professional personnel in governmental agencies or educational institution engaged in occupational safety and health programs.

AIHA - the American Industrial Hygiene Association was founded in 1939 by a group of industrial hygienists as a result of the need for an association devoted exclusively to industrial hygiene. The AIHA is a national professional society of persons engaged in protecting the health and well-being of workers and the general public through scientific application of knowledge concerning the chemical, engineering, physical, biological, or medical principles to minimize environmental stress and to prevent occupational disease.

ANSI - the American National Standards Institute is a federation of trade associations, technical societies, professional groups, and consumer organizations which constitutes the United States clearinghouse and coordinating body for voluntary (consensus) standards on the national level. The standards are subject to periodic review and users are cautioned to obtain the latest editions.

EPA - the Environmental Protection Agency is a Federal agency established in 1970. Under the Toxic Substances Control Act of 1976, it is required to ensure the safe manufacture, use, and transportation of hazardous materials. The EPA may require manufacturers to conduct tests on materials or products which adversely affect the environment of public health and safety.

NFPA - the National Fire Protection Association is an organization devoted to promoting the knowledge of fire protection methods. For many years the NFPA handbook has been the accepted standard for all matters relating to combustion and flammable materials, fire fighting methods, safety, and protection of property.

NRC - the Nuclear Regulatory Commission is a federal agency (with its roots in the Atomic Energy Commission (1946)), was established in 1975 to regulate all commercial uses of atomic energy, including construction and operation of nuclear power plants, nuclear fuel reprocessing plants, and research application of radioactive materials. It is also responsible for safety and environmental protection.

EXPOSURE LIMITS

- OSHA Permissible Exposure Limit
- ACGIH Threshold Limit Value
- NIOSH Recommended Exposure Limit
- AIHA Workplace Environmental Exposure Limit
- MAK Maximum Concentration Value
- Manufacturers' Recommendations

THRESHOLD LIMIT VALUE (TLV)

- Airborne concentrations to which nearly all workers may be routinely exposed.
- Individual susceptibility
- Based on experimental human/animal studies, industrial experience, and chemical similarity.

THRESHOLD LIMIT VALUE TIME WEIGHTED AVERAGE (TLV-TWA)

- TWA concentrations for 8-hour exposures
- Assumes 40 hour work week
- Frequently updated

THRESHOLD LIMIT VALUE SHORT TERM EXPOSURE LIMIT (TLV-STEL)

- 15 minute TWA
- 60 minutes between successive exposures
- Not more than four times per day
- TLV-TWA must not be exceeded

THRESHOLD LIMIT VALUE - CEILING (TLV-C)

- A concentration that should never be exceeded during any portion of the workday.

SKIN NOTATION (S)

- Substance may contribute to dose through absorption through the skin
- Not quantifiable

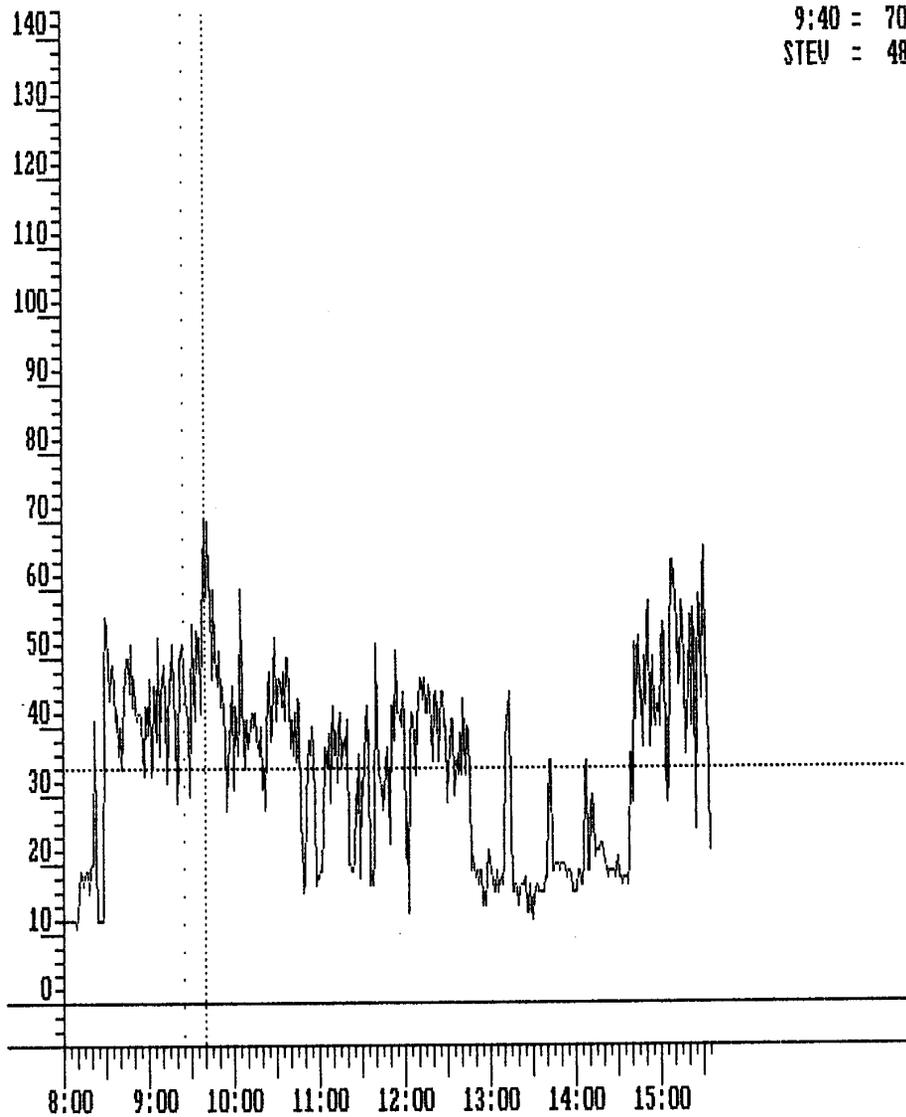
IMMEDIATELY DANGEROUS TO LIFE OR HEALTH (IDLH)

OSHA

An atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individuals ability to escape from a dangerous atmosphere.

NIOSH term

A threat of exposure to airborne contaminants when that exposure is likely to cause death or permanent adverse health effects or prevent escape from the environment



Comment :

Date = 8/25/1992 Start Time = 8:00h Serial No. = 039
 GAS = CO TWA = PEL 35 ppm STEL = CEILING 200 ppm basis 1 min
 TWA = 34 ppm for 7:35h STEL =
 PEAK = 70 ppm at 9:40h STEV = 56 ppm at 9:48h basis 15 min
 Overrange did not occur

Substance Specific Standards

- Acrylonitrile (29 CFR 1910.1045)
- Arsenic (Inorganic) (29 CFR 1910.1018)
- Asbestos (29 CFR 1910.1001)
- Benzene (29 CFR 1910.1028)
- Cadmium (29 CFR 1910.1027)
- 13 Carcinogens* (29 CFR 1910.1003)
- 1,3-Butadiene (29 CFR 1910.1051)
- Coke Oven Emissions (29 CFR 1910.1029)
- Cotton Dust (29 CFR 1910.1043)
- 1,2-Dibromo-3-chloropropane (29 CFR 1910.1044)
- Ethylene oxide (29 CFR 1910.1047)
- Formaldehyde (29 CFR 1910.1048)
- Lead (29 CFR 1910.1025)
- Methylene Chloride (29 CFR 1910.1052)
- Methylenedianiline (29 CFR 1910.1050)
- Vinyl chloride (29 CFR 1910.1017)

***The thirteen carcinogens standard is a collection of chemicals whose standards were essentially the same. Therefore, OSHA decided to group the following chemicals into the same standard, 1910.1003 (Federal Register 61 pgs. 31427-434, June 20, 1996). These are not the only carcinogenic substances on the above list, they were merely grouped together because these thirteen carcinogens happen to be regulated similarly.**

The compounds are: 2-Acetylaminofluorene, 4-Aminodiphenyl, Benzidine, bis-Chloromethyl ether, 3,3-Dichlorobenzidine (and its salts), 4-Dimethylaminoazobenzene, Ethyleneimine, Methyl chloromethyl ether, alpha-naphthylamine, beta-naphthylamine, 4-nitrophenyl, N-Nitrosodimethylamine, beta-Propiolactone.

Other OSHA codes in which respiratory protection is mentioned

1910 general industry
1915 shipyards
1917 marine terminals
1918 longshoring
1926 construction

1. 1910.94 - Ventilation
2. 1910.111 - Storage and handling of anhydrous ammonia
3. 1910.120 - Hazardous waste operations and emergency response.
4. 1910.124 - General requirements for dipping and coating
5. 1910.139 - Respiratory protection for M. tuberculosis.
6. 1910.146 - Permit-required confined spaces
7. 1910.156 - Fire Brigades
8. 1910.1450 - Occupational exposure to hazardous chemicals in laboratories.
9. 1915.154 - Respiratory protection.
10. 1915.12 - Precautions and the order of testing before entering confined and enclosed spaces and other dangerous atmospheres. operations
11. 1915.34 - Mechanical paint removers

12. 1917.92 - Respiratory protection.
13. 1918.102 - Respiratory protection.
14. 1926.57 - Ventilation.
15. 1926.65 - Hazardous waste operations and emergency response
16. 1926.103 - Respiratory protection.
17. 1926.651 - Specific Excavation Requirements

ANSI Standards

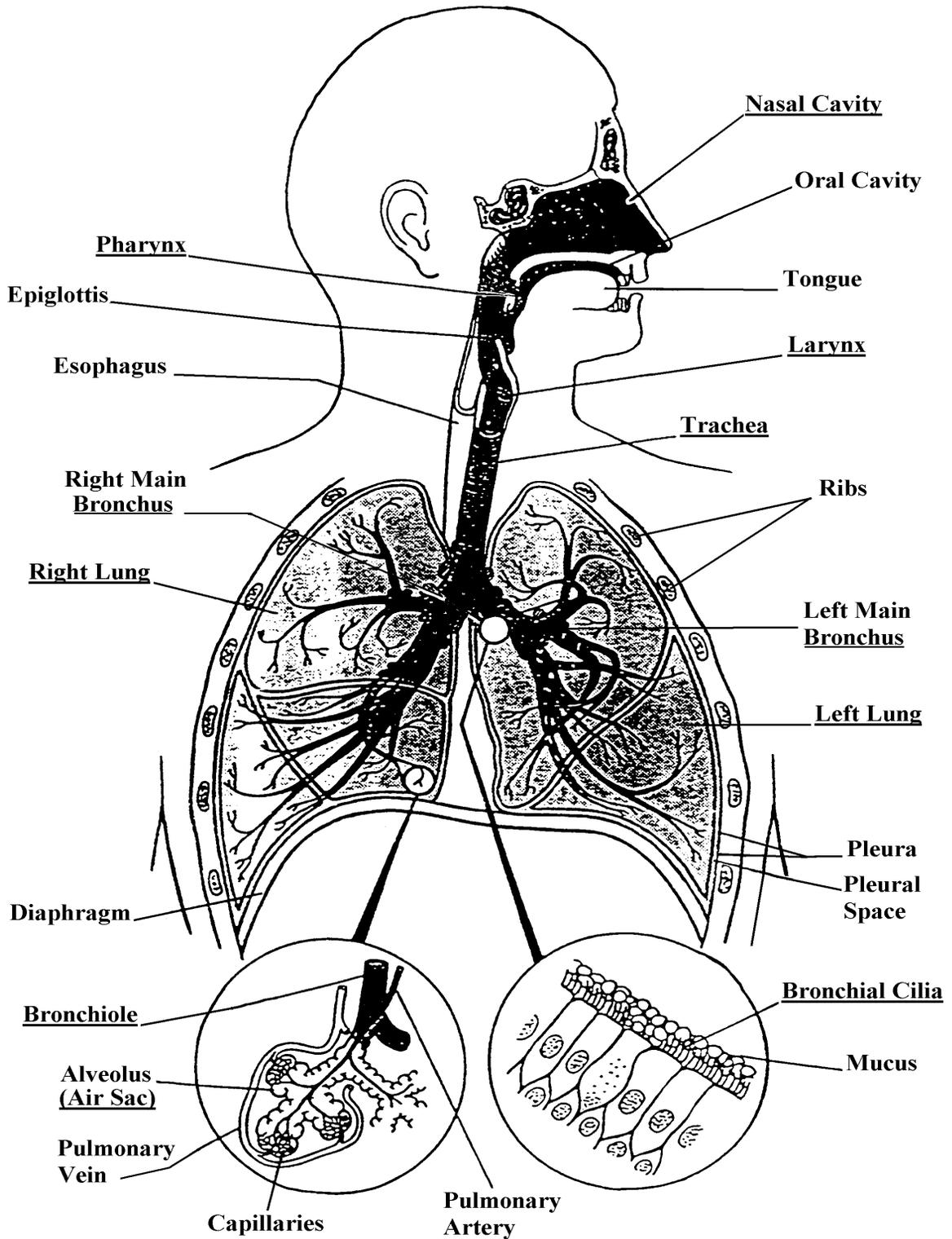
Document Number	Developer	Status
1. <u>ANSI Z88.10-2001</u>	AIHA	American National Standard
Title: Respirator Fit Testing Methods		
2. <u>ANSI Z88.7-2001</u>	AIHA	American National Standard
Title: Color-Coding of Air-Purifying Respirator Canisters, Cartridges and Filters		
3. <u>BSR Z88.12-199x</u>	AIHA	
Title: Respirator Protection for Infectious Aerosols		
4. <u>BSR Z88.14-200x</u>	AIHA	
Title: Respirator Use For Emergency Response And Operations Against Terrorism And Weapons Of Mass Destruction		
5. <u>BSR Z88.2-200x</u>	AIHA	
Title: Practices for Respiratory Protection		
6. <u>BSR Z88.6-199x</u>	AIHA	
Title: Respirator Use - Physical Qualifications for Personnel		
7. <u>BSR Z88.8-200x</u>	AIHA	
Title: Test Methodologies for Air Purifying Respirators		

BSR = Board of Standards Review

AIHA = American Industrial Hygiene Association

**RESPIRATORY PROTECTION
ANATOMY AND PHYSIOLOGY**

The Respiratory System



THE PULMONARY SYSTEM

- Exchange Oxygen and Carbon Dioxide
- Conduit and Oxygen Exchange Area

The Lungs

- Very large surface area
e.g., 260 M² in healthy male (or, about 145 times greater than surface area of external skin)
- Very thin membrane required at gas exchange area
(only 1/2 to 1 micron thick in healthy persons)

Respiratory System

- Function:
Gas exchange between atmosphere & blood
- Parts:
Upper respiratory system: Mouth, nose, pharynx, larynx
Lower respiratory system: Trachea, bronchi, bronchioles, alveoli

The Nose

- Warms, cools air
- Humidifies air
- Filter particulates ≥ 10 microns
(nose hairs and turbinate impaction)
- Reacts with water-soluble gases

Preferred entrance of air

The Pharynx

- The chambers which collects incoming food and air
- Passes air to trachea
- Regulates air pressure and velocity
- Filters particles (2 to 10 microns) through impaction
- Reacts with water soluble gases

Conducting Airways (Conduit)

- Trachea, Bronchi, Segmental Bronchi, Nonrespiratory Bronchioles
- Ciliated, Mucus Secreting
- Reduce in Diameter, Air Velocity the Further Down in System, Mucus Velocity
- Increase in Number of Generations, Surface Area

CONDUCTING AIRWAYS			RESPIRATORY UNIT	
TRACHEA	SEGMENTAL BRONCHI	SUBSEGMENTAL BRONCHI (BRONCHIOLES)		ALVEOLAR DUCTS
		Nonrespiratory	Respiratory	
GENERATIONS	8	16	24	26

The Trachea

- Largest conduit
- “Windpipe”
- Passage from pharynx to lungs
- Filters particles 2 to 10 microns
- Very sensitive, coughing reflex

The Bronchi

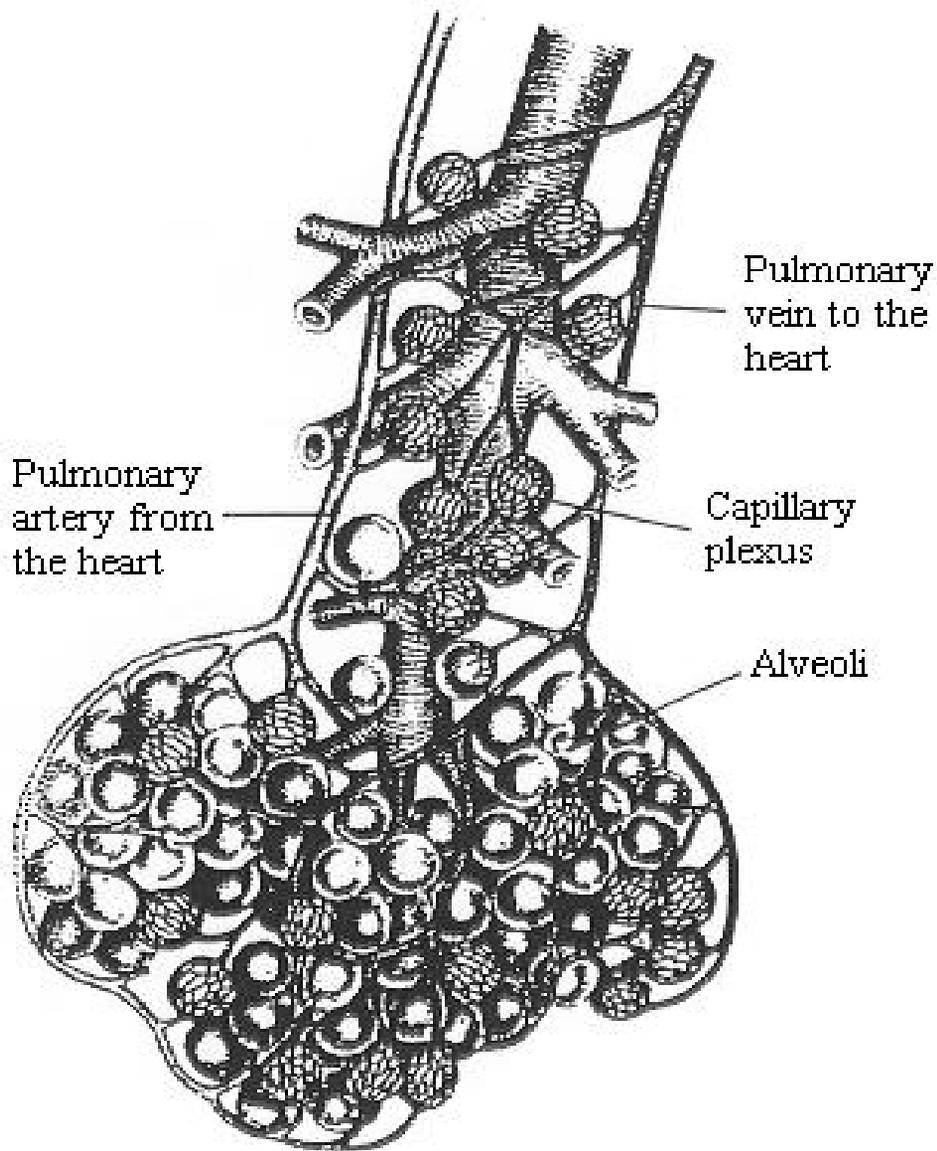
- Two subdivisions of the trachea
- One for each lung
- These further subdivide into segmental bronchi
- Filters particles 2 to 10 microns

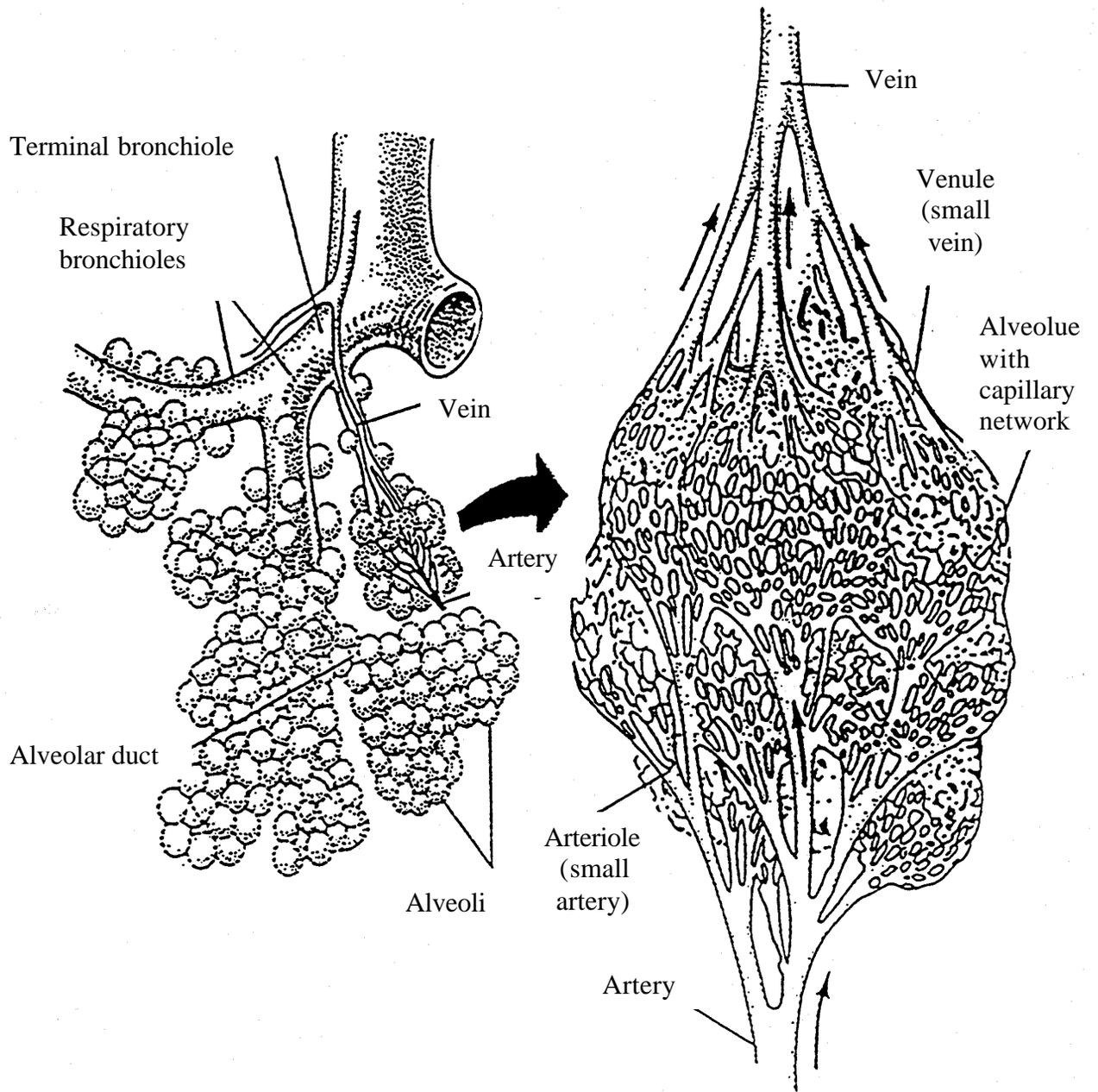
The Bronchioles

- Smaller subdivisions of bronchi
- Lower velocity = Settling
- Flow less turbulent
- Removes particles from 0.5 to 2 microns
- Smooth muscle layer constricts

The Alveoli (Air Exchange)

- Respiratory Bronchioles and Alveolar ducts
- Small air sacs
- Covered with capillaries
- Pulmonary Artery
- Pulmonary Vein
- Immunologic Protection (Macrophage)





Factors Determining Deposition

- Size
- Density
- Shape (fibers, aspect ratio)
- Solubility (Water vs. Lipid solubility) (HF, Mineral Spirits)

Types of Pulmonary Disease

- Obstructive - Asthma, Bronchitis, COPD, Emphysema
- Restrictive - Lung cannot expand fully or oxygen transfer inhibited - Hypersensitivity Pneumonitis, Asbestosis, Silicosis, Black Lung, Berylliosis

Types of Defense

- Nose hair / Turbinates
- Impaction / Centrifugal / Cyclonic
- Cough reflex, Sneeze reflex
- Mucus blanket, Ciliated Cells
- Bronchioconstriction
- Settling, Brownian motion
- Immune response

AIR PURIFYING

Cleans existing air

Negative Pressure

User “powers”, or brings air through a filter or purifying element through the negative pressure created by inhalation and respiration.

Advantages: Least expensive, least maintenance; Least cumbersome

Disadvantages: Protection partly dependent on the effectiveness of the filter or purifying element, greater potential for selection errors. Greatest potential for facepiece leakage, greater breathing resistance.

Powered Air Purifying

A small, battery operated pump pulls air through a filter or purifying element and delivers purified air to the user. The filters or purifying elements are usually larger than those on negative pressure devices.

Advantages: User not responsible for “powering” the movement of air through purifying element; less breathing resistance.

Disadvantages: Protection partly dependent on the effectiveness of the filter or purifying element. Greater potential for selection errors. More expensive, more maintenance, more cumbersome.

AIR SUPPLYING

Supplies a clean source of air to the user. Usually at ≤ 125 psi, ≥ 4 cfm (tight fitting), or between 6 and 15 cfm (loose fitting).

Advantages Removes risk of filter or purifying element failure;

Disadvantages: Generally more cumbersome; more expensive; more maintenance.

Airline

Air is supplied from a large cylinder of clean air (Grade D or better) or a compressor located in a non-contaminated area via a long hose, not more than 300 feet. The cylinder or compressor are not worn by the user.

Advantages: Greater protection because of less chance for facepiece leakage compared to an air purifying respirator. Can provide cooler air in hot work environments. Longer air supply than SCBA; less weight;

Disadvantages: Because of long hose, there is a risk of the hose becoming damaged, thus introduces the potential for contaminated air entering the facepiece.

SCBA

Air is supplied from a small cylinder of clean air (≤ 35 pounds) to the facepiece via a short hose.

Advantages: Greater protection because of less chance for facepiece leakage compared to an air purifying respirator. Can provide cooler air in hot work environments. Greatest protection factor, because air source is always with user; less potential for hose damage.

Disadvantages: Weight, size can be restrictive, even potential safety hazard, more physically demanding.

Airline Respirator Modes of Operation

Airline respirators operate in one of three different modes.

Demand Mode

Respirable air is admitted into the facepiece only when a negative pressure is created inside the facepiece by inhalation.

Continuous Flow Mode

The facepiece is maintained at a higher pressure relative to ambient pressure by the continuous flow of breathing air from the source to the facepiece. The flow of supplied air is not increased when a negative pressure is created in the facepiece by inhalation.

Pressure-Demand Mode

The facepiece is maintained at a higher pressure relative to ambient pressure and admits respirable air whenever the pressure inside the facepiece is reduced. This is the most protective mode, because the facepiece is always under a positive pressure.

AIR SUPPLYING RESPIRATOR TYPES

Type A – Hose Mask with a Blower

Type B – Hose Mask without a Blower

Type C – Airline Respirator (under pressure)

E = protection for head and neck

Example: Type CE is an airline respirator with head and neck protection.
Type CE is required for abrasive blasting operations.

Types of Facepieces

Tight Fitting

Seal is made between the facepiece and the user's face. Can be air purifying or supplied air.

Full Face

A facepiece that covers the nose, mouth and eyes. It seals around the forehead, down the side of the face, and under the chin. Seal is the greatest because the sealing surface is the flattest.

Half Face

A facepiece which covers the nose and mouth and seals under the chin and around the nose.

Quarter Face

A facepiece which covers the nose and mouth, but seals around the bottom lip.

Loose Fitting

No seal is made between the facepiece and the user's face. Are either airline or powered air purifying respirators.

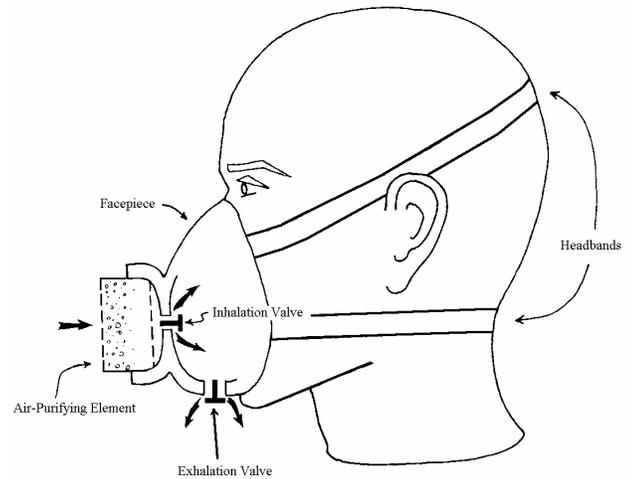
Hood

A configuration which completely covers the head, neck, and sometimes shoulders.

Helmet

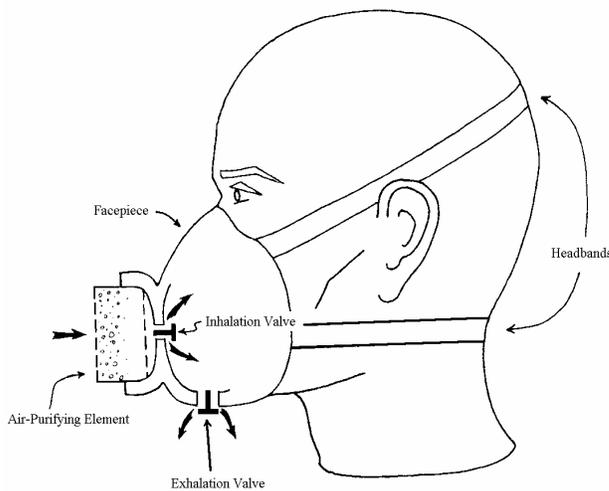
A hood which provides protection against impact and penetration.

Types of Respirator Facepieces



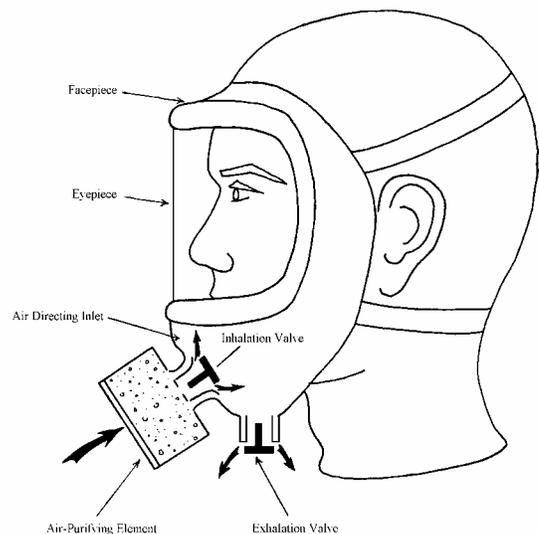
Quarter Mask Respirator

(Seals Under Bottom Lip & Over the Nose)



Half Mask Respirator

(Seals Under Chin & Over the Nose)



Full Face Respirator

(Seals Under Chin & Around the Forehead) (Covers the Eyes)

Source: NIOSH Guide to Industrial Respiratory Protection publication 87-116

ASSIGNED PROTECTION FACTORS (APFs)

OSHA is attempting to assimilate information from the National Institute for Occupational Safety and Health (NIOSH), the American National Standards Institute (ANSI), and other sources into a single set of assigned protection factors (APFs). APFs are the number of times above the exposure limit for which a given respirator provides protection (i.e., for a substance with a 10 ppm exposure limit, a respirator with an APF of 10 would protect against atmospheres containing up to 100 ppm of that substance), given that other limitations such as Immediately Dangerous To Life or Health (IDLH) concentrations or Maximum Use Concentrations (MUC) for the cartridges are not exceeded. Below are the NIOSH and ANSI APFs either of which can be used until OSHA publishes its own APFs. OSHA, however, will use the NIOSH numbers in the interim.

Respirator Type	NIOSH Respirator Decision Logic			ANSI Z88.2-1992
	Particulate Hazards	Gas/Vapor Hazards	Combination Gas/Vapor & Particulate Hazards	Any Hazard
1 Single-use or quarter mask	5	NA	NA	10
2 APR half-mask except single use	10**	10****	10	10
3 APR full-facepiece or gas mask	10/50***	50	10/50***	100
4 SAR half-mask, demand	10	10	10	10
5 SAR full-facepiece demand	50	50	50	100
6 SAR hood or helmet, loose-fitting continuous*	25	25	25	25
7 SAR hood or helmet, tight-fitting continuous*	25	25	25	1,000
8 SAR half-mask, continuous	50	50	50	50
9 SAR full-facepiece, continuous	50	50	50	1,000
10 PAPR hood or helmet, loose-fitting*	25	25	25	25
11 PAPR hood or helmet, tight fitting*	25	25	25	1,000***
12 PAPR half-mask	50***	50	50***	50
13 PAPR full-facepiece	50***	50	50***	1,000***
14 SCBA full-facepiece, demand	50	50	50	100
15 SAR half-mask, pressure demand	1,000	1,000	1,000	50
16 SAR full-facepiece, pressure demand	2,000	2,000	2,000	1,000
17 SCBA full-facepiece, pressure demand	10,000	10,000	10,000	10,000
18 SAR full-facepiece, pressure demand with auxiliary SCBA	10,000	10,000	10,000	NA

APR – Air-purifying respirator
 SAR – Supplied-air respirator
 PAPR – Powered air-purifying respirator
 SCBA – Self-contained breathing apparatus

*NIOSH does not differentiate between loose- and tight-fitting hoods and helmets
 ** Including disposable if properly fitted using a quantitative fit test
 ***Equipped with a high-efficiency filter and quantitative fit-test
 ****Including disposable

MAXIMUM USE CONCENTRATION (MUC) APF (of the respirator) X Exposure Limit
LIMITATIONS TO THE MUC
1. IDLH 2. Cartridge Limit

Cartridge Limits (from 42 CFR 84)	
Ammonia	300 ppm
Chlorine	10 ppm
Hydrogen Chloride	50 ppm
Methylamine	100 ppm
Organic Vapors	1,000 ppm
Sulfur Dioxide	50 ppm
Vinyl Chloride	10 ppm

FIELD INSPECTION PROTOCOL

FACEPIECE

- excessive dirt
- cracks, tears, holes, or distortion from improper storage inflexibility
- cracked or badly scratched lenses in full-facepieces
- incorrectly mounted full-facepiece lens or broken or missing mounting clips
- cracked or broken air-purifying element holder(s), badly worn threads, or missing gasket(s) if required

HEADSTRAPS (HARNES)

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

EXHALATION VALVE FOR:

- foreign material, such as detergent residue, dust particles, or human hair under the valve seat
- cracks, tears, or distortion in the valve material
- improper insertion of the valve body in the facepiece
- missing or defective valve cover
- improper installation of the valve in the valve body

AIR-PURIFYING ELEMENTS

- incorrect cartridge, canister, or filter for the hazard
- incorrect installation, loose connections, missing or worn gaskets,
- expired shelf-life date on the cartridge or canister
- cracks or dents in the outside case of the filter, cartridge, or canister

SCBAs and supplied air

- broken or missing end connectors on breathing tubes
- missing or loose hose clamps
- deterioration of the rubber, determined by stretching the tube and looking for cracks
- regulator and warning devices working properly
- abrasive blasting hoods must have the protective screen intact and secured correctly over the face shield
- integrity and good condition of air supply lines and hoses
- air quality (quality of air in SCBA tanks, intake location)
- incompatible airline connections

CLEANING AND DISINFECTING

The OSHA requirements in 29 CFR 1910.134 (Appendix B-2) are specific about cleaning and disinfecting procedures, stating that "routinely used respirators shall be collected, cleaned, and disinfected as frequently as necessary to insure that proper protection is provided." and that emergency use respirators "shall be cleaned and disinfected after each use."

- Disassembly
- Wash
- Rinse
- Drain
- Sanitize
- Rinse
- Hand or air dry
- Reassemble
- Test

STORAGE

Storage should protect from:

- Dust
- Sunlight
- Heat
- Extreme cold
- Excessive moisture, and
- Damaging chemicals

It is strongly recommended freshly cleaned respirators be placed in heat-sealed or reusable plastic bags. They should be stored in a clean, dry location away from direct sunlight. They should be stored in a single layer with the facepiece and exhalation valve in a more or less normal position to prevent the rubber or plastic from taking a permanently distorted.

Routinely used respirators may be stored in a variety of ways if they are protected against the substances and condition listed at the beginning of this page. This means that when a respirator is not in use, it should be stored in a plastic bag inside a rigid container. The adequately trained worker should develop a respect for respirators which will automatically (hopefully) provide incentive to protect it from damage.

RESPIRATOR INSPECTION RECORD

1. TYPE _____ 2. NO. _____

3. DEFECTS FOUND:

a. Facepiece _____

b. Inhalation Valve _____

c. Exhalation Valve Assembly _____

d. Headbands _____

e. Cartridge Holder _____

f. Cartridge / Canister _____

g. Filter _____

h. Harness Assembly _____

i. Hose Assembly _____

j. Speaking Diaphragm _____

k. Gaskets _____

l. Connections _____

m. Other Defects _____

**CHECKLIST FOR INSPECTION OF DEMAND OR PRESSURE DEMAND, OPEN
CIRCUIT SELF-CONTAINED BREATHING APPARATUS WITH MODE SELECT LEVER:**

PRIOR TO BEGINNING INSPECTION

1. Check to assure that high pressure hose connector is tight on cylinder fitting.
2. Bypass valve closed.
3. Mainline valve open and locked (when lock present).
4. Select lever (if present) on demand mode.
5. No cover or obstruction on regulator outlet.

I. BACK PACK & HARNESS ASSEMBLY

A. Straps

1. Visually inspect for complete set.
2. Visually inspect for frayed or damaged straps that may break during use.

B. Buckles

1. Visually inspect for mating ends.
2. Check locking function.

C. Backplate & Cylinder Lock

1. Visually inspect backplate for cracks and for missing rivets or screws.
2. Visually inspect cylinder hold down strap and physically check strap tightener and lock to assure that it is fully engaged.

II. CYLINDER & CYLINDER VALVE ASSEMBLY

A. Cylinder

1. Physically check cylinder to assure that it is tightly fastened to back plate.
- (M) 2. Check Hydrostatic Test Date to assure it is current.
- (M) 3. Visually inspect cylinder for large dents or gouges in metal.

B. Head & Valve Assembly

- (M) 1. Visually inspect cylinder valve lock for presence.
- (M) 2. Visually inspect cylinder gauge for condition of face, needle, and lens.
3. Open cylinder valve and listen or feel for leakage around packing. (If leakage is noted, do not use until repaired.) Note function of valve lock.

NOTE: Final test of facepiece would involve a negative pressure test for overall seal and check of exhalation valve. If doing a monthly inspection, mask may now be placed against the face and following tests performed. If preparing for use, don backpack, then don facepiece and use the following procedure.

C. Negative Pressure Test on Facepiece

1. With facepiece held tightly to face or facepiece properly donned, stretch breathing tube to open corrugations and place thumb or hand over end of connector. Inhale. Negative pressure should be created inside mask, causing it to pull tightly to face. This negative pressure should be maintained for 5-10 seconds. If negative pressure leaks down, the facepiece assembly is not adequate and should not be worn.

NOTE: On Scott Pressur-Pak II and IIA facepiece units only, place connector end of the breathing tube approximately 1/4 - 1/2 inch from palm of hand and exhale. If you notice any air returning through tube, the mask should not be used.

STORAGE OF UNITS

1. Cylinder refilled as necessary and unit cleaned and inspected.
2. Cylinder valve closed.
3. High pressure hose connector tight on cylinder.
4. Pressure bled off of high pressure hose and regulator.
5. Bypass valve closed.
6. Mainline valve open. (When mainline valve lock present, it should be engaged.)
7. Select lever, if present, on demand mode.
8. All straps completely loosened and laid straight.
9. Facepiece properly stored to protect against dust, sunlight, heat, extreme cold, excessive moisture, and damaging chemicals.

ITEMS MARKED (M) would be done only on monthly inspection.

NOTE: Any discrepancy found should be cause to set unit aside until repair can be done by certified repair person.

CHECKLIST FOR INSPECTION OF PRESSURE DEMAND SELF-CONTAINED BREATHING APPARATUS WITHOUT MODE SELECT LEVER:

PRIOR TO BEGINNING INSPECTION

1. Check to assure that high pressure hose connector is tight on cylinder fitting.
2. Bypass valve closed.
3. Mainline valve closed.
4. No cover or obstruction on regulator outlet.

I. BACK PACK & HARNESS ASSEMBLY

A. Straps

1. Visually inspect for complete set.
2. Visually inspect for frayed or damaged straps that may break during use.

B. Buckles

1. Visually inspect for mating ends.
2. Check locking function.

C. Backplate & Cylinder Lock

1. Visually inspect backplate for cracks and for missing rivets or screws.
2. Visually inspect cylinder hold down strap and physically check strap tightener and lock to assure that it is fully engaged.

II. CYLINDER & CYLINDER VALVE ASSEMBLY

A. Cylinder

1. Physically check cylinder to assure that it is tightly fastened to back plate.
- (M) 2. Check Hydrostatic Test Date to assure it is current.
- (M) 3. Visually inspect cylinder for large dents or gouges in metal.

B. Head & Valve Assembly

- (M) 1. Visually inspect cylinder valve lock for presence.
- (M) 2. Visually inspect cylinder gauge for condition of face, needle, and lens.
3. Open cylinder valve and listen or feel for leakage around packing. (If leakage is noted, do not use until repaired.) Note function of valve lock.

NOTE: Final test of facepiece would involve a negative pressure test for overall seal and check of exhalation valve. If doing a monthly inspection, mask may now be placed against the face and following tests performed. If preparing for use, don backpack, then don facepiece and use the following procedure.

C. Negative Pressure Test on Facepiece

1. With facepiece held tightly to face or facepiece properly donned, stretch breathing tube to open corrugations and place thumb or hand over end of connector. Inhale. Negative pressure should be created inside mask, causing it to pull tightly to face. This negative pressure should be maintained for 5-10 seconds. If negative pressure leaks down, the facepiece assembly is not adequate and should not be worn.

V. STORAGE OF UNITS

1. Cylinder refilled as necessary and unit cleaned and inspected.
2. Cylinder valve closed.
3. High pressure hose connector tight on cylinder.
4. Pressure bled off of high pressure hose and regulator.
5. Bypass valve closed.
6. Mainline valve open. (When mainline valve lock present, it should be engaged.)
7. Select lever, if present, on demand mode.
8. All straps completely loosened and laid straight.
9. Facepiece properly stored to protect against dust, sunlight, heat, extreme cold, excessive moisture, and damaging chemicals.

ITEMS MARKED (M) would be done only on monthly inspection.

NOTE: Any discrepancy found should be cause to set unit aside until repair can be done by certified repair person.

PERSONAL ISSUE MASK
CLEANING AND MAINTENANCE RECORD

(sample)

EMP NO. 69532 TYPE MASK FF Mask G TYPE FILTER High Efficiency

Has Prescription Glasses in Mask YES No. of Masks Issued (1) (2)

CLEANING RECORD

DATE	REPAIRS	NOTE
2/1/99		New Issue
3/6/99	<i>Cleaned</i>	<i>Replace Lens</i>

DATE	REPAIRS	NOTE

NAME: Blow, Joe Q.

ORGANIZATION: AERO Nuclear, Health Physician

This type of record should be completed and forwarded to the Respirator Maintenance Section when a personalized mask is issued. Each time the mask is received for cleaning and maintenance, this record should be updated. Records of this nature are helpful in reducing instances of misuse and maltreatment of respiratory protective devices and assure that devices are cleaned and maintained on schedule.

(Sample)

SELF-CONTAINED BREATHING APPARATUS INSPECTION SHEET

DEVICE: _____ SN: _____
DATE INSPECTED: _____ INSPECTED BY: _____
LOCATION: _____ USER GROUP: _____
PERSON RESPONSIBLE FOR MONTHLY INSPECTION:

CHECK LIST

RUBBER FACEPIECE: _____ FOGPROOF: _____
RUBBER HEAD HARNESS: _____ AIR CYLINDER PRESSURE: _____
“O” RING (Reg. Connector) _____ BYPASS VALVE: _____
INHALATION VALVE: _____ MAINLINE VALVE: _____
EXHALATION VALVE: _____ ALARM: _____
FACEPIECE LENS: _____ REGULATOR DIAPHRAGM: _____
HARNESS: _____ REGULATOR FUNCTION: _____
BACKPACK: _____ DEMAND: _____
CLEANLINESS: _____ PRESSURE DEMAND: _____
INSTRUCTION SHEET: _____ STORAGE BOX: _____
WRENCH: _____

(Required Monthly)

COMMENTS:

(Sample)

EMERGENCY AIR-PURIFYING RESPIRATORY EQUIPMENT INSPECTION SHEET

DEVICE: _____ SN: _____
DATE INSPECTED: _____ INSPECTED BY: _____
LOCATION: _____ USER GROUP: _____
PERSON RESPONSIBLE FOR MONTHLY INSPECTION:

CHECK LIST

RUBBER FACEPIECE: _____ CANISTER: _____
RUBBER HEAD HARNESS: _____ Seals: _____
RUBBER HOSE: _____ Expiration Date: _____
EXHALATION VALVE: _____ EXTRA CANISTER _____
FACEPIECE LENS: _____ Type: _____
HARNESS: _____ Seals: _____
EXTERNAL CHECK VALVE: _____ Expiration Date: _____
STORAGE BOX: _____ CLEANLINESS: _____
INSTRUCTION SHEET: _____ FOGPROOF: _____

(Required Monthly)

COMMENTS:

STANDARD OPERATING PROCEDURE
DISASSEMBLY, CLEANING AND MAINTENANCE OF RESPIRATORS

1. Remove all cartridges, canisters or filters and all gaskets that are not affixed to seats.
2. Visually inspect facepieces and parts; discard faulty items.
3. Remove all elastic headbands.
4. Remove exhalation valve cover.
5. Remove speaking diaphragm or speaking diaphragms-exhalation assembly, or pressure-demand exhalation valve assembly.
6. Remove inhalation valves.
7. Wash, sanitize and rinse facepieces (see specific procedure for operation of washing equipment). (Maximum water temperature 140°F, optimum range 120° to 140°F). Parts removed from respirators may be washed separately as necessary.
8. Dry masks (see specific procedures for drying).
9. Hand wipe facepieces, valves and valve seats with damp, lint-free cloth to remove any soap or water residues, mold releases powders or foreign materials not removed by washing.
10. Disassemble and hand clean the pressure-demand and exhalation valve assembly, exercising care to avoid damage to the rubber diaphragm.
11. Visually inspect facepieces and all parts for deterioration, distortion, or other faults that might affect the performance of the respirators.
12. Replace any questionable or obviously faulty parts or assemblies including rubber components that show weather checking when flexed or stretched, and distorted facepiece. Replace only with parts specifically designed for the particular respirator.
13. Reassemble mask and visually inspect completed assembly.
14. Install new or retested filters, cartridges or canister.
15. Clean and apply fogproof to lens per fogproof manufacturer's instructions (full facepieces only).
16. Install lens cover.
17. Fogproof outside of lens cover.
18. Quality assurance test each completed unit (see specific procedure for QA test).
19. Individually seal each mask in plastic bag.

Medical Evaluation

1910.134 (e) Highlights

Who? Any employee who uses respiratory protection (with the exception of voluntary use of filtering facepieces) must be medically evaluated. A physician or licensed health care professional (PLHCP) performs the evaluation and recommends whether a particular respirator can be worn by the employee, and under what conditions the respirator can be worn.

Why? Respirators place an added physiological burden on the user (i.e. increased heart rate from breathing resistance, aggravation of pulmonary conditions, such as asthma, etc.).

What? Initially, either a medical questionnaire or a medical examination conducted by a physician or licensed health care professional (PLHCP) that obtains the same information as the questionnaire must be confidential. If either indicate the need, a follow-up examination may be required. The content of the follow-up will be determined by the PLHCP. The employer must provide the PLHCP with: detailed information concerning the nature of the work during respirator use; a copy of 1910.134; and the company's written respiratory protection program.

When? Upon initial issuance of respiratory protection; anytime an individual exhibits medical symptoms which could be related to medical use; follow-ups based on the frequency suggested by the PLHCP, changes in the workplace which could affect the physiological burden placed on the employee.

Where? The standard does not specify where the PLHCP must conduct the medical evaluation. Theoretically, it could be performed on- or off-site. If a questionnaire is used, the employee could complete it onsite, and send it to the PLHCP.

**CONSIDERATIONS USED BY MEDICAL
WHEN PERMITTING RESPIRATOR USAGE**

- 1) History of Spontaneous Pneumothorax
- 2) Claustrophobia – Anxiety
- 3) Moderate to Severe Pulmonary Disease
 - ◆ FCC below 60% of predicted
 - ◆ FEV/FCC below 60% of predicted
- 4) Treated and/or Unresponsive Hypertensive Cardiovascular Disease
- 5) Cardiac Disease
- 6) Weight – 25% or More Overweight
- 7) History of Thermal Stress – Heat Exhaustion

CONSIDERATIONS USED BY MEDICAL WHEN PERMITTING RESPIRATOR USAGE

from ANSI Standard Z88.2-1980

It is recommended that a physician determine if a person should or should not wear a respirator if the person has any of the following:

- 1) Emphysema
- 2) Chronic obstructive pulmonary disease
- 3) Bronchial asthma
- 4) X-ray evidence of pneumoconiosis
- 5) Evidence of reduced pulmonary function
- 6) Coronary artery disease or cerebral blood vessel disease
- 7) Severe or progressive hypertension
- 8) Epilepsy, grand mal or petit mal
- 9) Anemia, pernicious
- 10) Diabetes, insipidus or mellitus
- 11) Punctured eardrum
- 12) Pneumomediastinum gap
- 13) Communication of sinus through upper jaw to oral cavity
- 14) Breathing difficulty when wearing a respirator
- 15) Claustrophobia or anxiety when wearing a respirator

Medical Evaluation 1910.134 (e) requirements

- Medical evaluation before fit testing.
- Questionnaire in Appendix C or medical exam that obtains the same information as the questionnaire.
- Questionnaire Part A mandatory and Part B at discretion of PLHCP.
- Medical evaluation done by physician or other licensed health care professional (PLHCP).
- Follow-up medical exam for employees who give positive response to any question 1 through 8 in Section 2. (Many people are likely to answer yes to at least one of these questions.)
- Questionnaire and exam confidential and during time and place convenient for the employee.
- Information provided to PLHCP about the employees job duties, effort required, and type of respirator to be used.
- PLHCP must give a written recommendation regarding the employee's ability to use a respirator.
- If a negative pressure respirator can not be worn by the employee for medical reasons, the PLHCP may allow respirator use if a PAPR is provided. PAPR = powered air purifying respirator

SELECTION CONSIDERATIONS

GENERAL

- Respirator protection factor (APF, APFmin)
- Worker activity
- Location of the hazard area with respect to a hazard free area
- Respirator characteristics, capacities, and limitations
 - CC relative to EL (APFmin)
 - Change schedule
 - Filter efficiency
- Approved respirators
- Hazard determination (CC\EL)
- Chemical/Physical state (gas, vapor, aerosol)
- IDLH
- Oxygen deficiency
- Odor threshold / Warning properties
- Abrasive blasting
- Facial hair
- Communications
- Vision
- Low/High temperatures
- Maximum use concentration

ASSIGNED PROTECTION FACTORS (APFs)

OSHA is attempting to assimilate information from the National Institute for Occupational Safety and Health (NIOSH), the American National Standards Institute (ANSI), and other sources into a single set of assigned protection factors (APFs). APFs are the number of times above the exposure limit for which a given respirator provides protection (i.e., for a substance with a 10 ppm exposure limit, a respirator with an APF of 10 would protect against atmospheres containing up to 100 ppm of that substance), given that other limitations such as Immediately Dangerous To Life or Health (IDLH) concentrations or Maximum Use Concentrations (MUC) for the cartridges are not exceeded. Below are the NIOSH and ANSI APFs either of which can be used until OSHA publishes its own APFs. OSHA, however, will use the NIOSH numbers in the interim.

Respirator Type	NIOSH Respirator Decision Logic			ANSI Z88.2-1992
	Particulate Hazards	Gas/Vapor Hazards	Combination Gas/Vapor & Particulate Hazards	Any Hazard
1 Single-use or quarter mask	5	NA	NA	10
2 APR half-mask except single use	10**	10****	10	10
3 APR full-facepiece or gas mask	10/50***	50	10/50***	100
4 SAR half-mask, demand	10	10	10	10
5 SAR full-facepiece demand	50	50	50	100
6 SAR hood or helmet, loose-fitting continuous*	25	25	25	25
7 SAR hood or helmet, tight-fitting continuous*	25	25	25	1,000
8 SAR half-mask, continuous	50	50	50	50
9 SAR full-facepiece, continuous	50	50	50	1,000
10 PAPR hood or helmet, loose-fitting*	25	25	25	25
11 PAPR hood or helmet, tight fitting*	25	25	25	1,000***
12 PAPR half-mask	50***	50	50***	50
13 PAPR full-facepiece	50***	50	50***	1,000***
14 SCBA full-facepiece, demand	50	50	50	100
15 SAR half-mask, pressure demand	1,000	1,000	1,000	50
16 SAR full-facepiece, pressure demand	2,000	2,000	2,000	1,000
17 SCBA full-facepiece, pressure demand	10,000	10,000	10,000	10,000
18 SAR full-facepiece, pressure demand with auxiliary SCBA	10,000	10,000	10,000	NA

APR – Air-purifying respirator
 SAR – Supplied-air respirator
 PAPR – Powered air-purifying respirator
 SCBA – Self-contained breathing apparatus

*NIOSH does not differentiate between loose- and tight-fitting hoods and helmets
 ** Including disposable if properly fitted using a quantitative fit test
 ***Equipped with a high-efficiency filter and quantitative fit-test
 ****Including disposable

MAXIMUM USE CONCENTRATION (MUC) APF (of the respirator) X Exposure Limit
LIMITATIONS TO THE MUC
1. IDLH 2. Cartridge Limit

Cartridge Limits (from 42 CFR 84)	
Ammonia	300 ppm
Chlorine	10 ppm
Hydrogen Chloride	50 ppm
Methylamine	100 ppm
Organic Vapors	1,000 ppm
Sulfur Dioxide	50 ppm
Vinyl Chloride	10 ppm

Filter efficiency ⇨ Filter series ↓	95%	99%	100% (99.97%)
Not Resistant to oil (N)	N95	N99	N100
Resistant to oil (R)	R95	R99	R100
Oil Proof (P)	P95	P99	P100

If you currently use... (30 CFR 11 product)	In applications involving...	According to the NIOSH User's Guide you could now choose...
Dust / Mist Filter or Respirator	Grinding, sanding, sawing, lathe work	No oil present: N95
		Oil present: R or P95
Dust / Fume / Mist Filter or Respirator	Welding, metal pouring, brazing, soldering	No oil present: N95
		Oil present: R or P95
HEPA Filter or Respirator	Cadmium, asbestos, lead	No oil present: N100
		Oil present: R or P100

Source: "Reviewing the NIOSH User's Guide – A 3M Perspective"

Selection

$$\frac{CC}{EL} = APF_{\min}$$

Where CC = Contaminant Concentration,
 EL = Exposure Limit, and
 APF_{min} = Assigned Protection Factor Minimum

MAXIMUM USE CONCENTRATION = APF_(of the respirator) X EL

However it is LIMITED BY.....

1. the IDLH
2. the Cartridge limit

Cartridge Limits (from 42 CFR 84):

Ammonia	300 ppm
Chlorine	10 ppm
Hydrogen Chloride	50 ppm
Methylamine	100 ppm
Organic Vapors	1,000 ppm
Sulfur dioxide	50 ppm
Vinyl Chloride	10 ppm

SAMPLE SELECTION CALCULATIONS

1. Styrene – Given the following information what is the APF_{min} ?

8-Hour time weighted average exposure (CC) = 550 ppm

OSHA PEL = 100 ppm

ACGIH = 20 ppm

NIOSH REL = 50 ppm

$$\text{OSHA } APF_{min} = \frac{550}{100} = 5.5 \quad \text{ACGIH } APF_{min} = \frac{550}{20} = 27.5 \quad \text{NIOSH } APF_{min} = \frac{550}{50} = 11$$

2. Carbon Black – What is the APF_{min} if an employee is exposed to a time-weighted average concentration of 70 mg/m³?

OSHA PEL = 3.5 mg/m³

ACGIH TLV = 3.5 mg/m³

NIOSH REL = 3.5 mg/m³

$$\text{OSHA } APF_{min} = \frac{70}{3.5} = 20 \quad \text{ACGIH } APF_{min} = \frac{70}{3.5} = 20 \quad \text{NIOSH } APF_{min} = \frac{70}{3.5} = 20$$

3. Ethyl Benzene – A half-mask air-purifying respirator is used for protection for ethyl benzene. What is the highest concentration that this respirator can be used for (maximum use concentration)?

Assigned Protection Factor (APF) = 10

OSHA PEL, ACGIH TLV, & NIOSH REL = 100 ppm

$$APF \times EL = 10 \times 100 \text{ ppm} = 1000 \text{ ppm}$$

However, remember the maximum use concentration limitations:

Cartridge Limit: Organic vapor = 1000 ppm

IDLH = 800 ppm

So even though this type of respirator is allowed for use up to 1000 ppm (10x the exposure limit), the IDLH limits its use to 800 ppm.

PURPOSE OF A RESPIRATOR FIT TEST

The purpose of a qualitative or quantitative respirator fit test is to verify that the respirator user:

1. Has selected a respirator that is not uncomfortable, and can reasonably be worn, without frequent shifting and adjustment, for the periods of time that the user must wear a respirator.
2. Can properly inspect the respirator and identify faulty parts.
3. Can properly don the respirator, properly position and adjust straps or harness, and seat the respirator seal to his or her face.
4. Can properly perform positive and/or negative pressure tests to confirm that a gas tight/dust tight seal of the respirator facepiece to the face has been obtained, and that no apparent faults in the respirator exist.
5. Can maintain the gas tight/dust tight seal throughout a series of representative work movements. (The work movements must be carefully selected to cause stresses on the strap or harness suspension, and thus on the facepiece to face seal, as would be experience during normal work routines.)

ULTIMATE RESULTS OF PASSING A PROPERLY CONDUCTED QLFT OR QNFT

Passing the test should verify that any properly maintained respirator of the same make and model, used by that wearer while performing his or her normal work routine, in an atmosphere containing the concentration of not greater than the respirator assigned protection factor times the permissible exposure limit,(APF x PEL), will allow penetration of less than or equal to 1 PEL between the facepiece and face seal.

Information courtesy of Bevis Associates International, Inc.

RESPIRATOR FIT TESTING TERMINOLOGY

APF Assigned protection factor (APF): the minimum expected workplace protection that would be provided by a properly functioning respirator or class of respirators to a stated percentage of properly fitted and trained users. The NIOSH APFs are commonly used such as 10 for a half mask or 50 for a full face with HEPA cartridges.

APF_{min} Assigned protection factor minimum (APF_{min}): The minimum respirator APF necessary to provide adequate protection for the user based on the contaminant concentration. Calculated using the contaminant concentration (CC) divided by the contaminant's exposure limit (EL).

For example, a particulate regulated concentration (the CC) of 315 mg/m³ and an OSHA PEL of 15 mg/m³ (the EL), the APF_{min} is 315÷15=21. Based on this we need to select a respirator with an APF of at least 21. Selection is based on the limitations of the respirator class, the air purifying elements, contaminant's concentration, etc.

FF Fit factor (also quantitative FF): a quantitative measure of the fit of a respirator facepiece to a particular individual's face. Determined by a quantitative fit test using a challenge aerosol such as sodium chloride (NaCl), corn oil, or ambient particles. Calculated using the ratio of the concentration of the aerosol outside the respirator (C_o) and the concentration inside the respirator (C_i) due to leakage, C_o/C_i.

MUC Maximum use concentration (MUC): the maximum concentration of a contaminant that a properly functioning respirator or class of respirators when properly fitted and worn can be safely used. Calculated using the formula: MUC=APF x EL. Must consider the limitations of the respirator, IDLH concentration, irritation level and other factors when using this formula.

WPF Workplace protection factor (WPF): a measure of the actual protection provided by a properly functioning, fitted and used respirator during actual workplace use. WPF is the ratio of the concentration of the contaminant outside the respirator (C_o) and the concentration inside the respirator (C_i) due to leakage, C_o/C_i. This is determined by concurrent air sampling while the respirator is worn during normal work duties.

FF¹PF

FF

The mathematical ratio of the concentration of the challenge agent outside the mask versus inside the mask as determined from the quantitative fit tested.

PF

The degree of protection afforded by a given respiratory protection device as determined by laboratory experiments. This is the only factor to be used when choosing the degree of protection.

THE 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 his reach, his friends say he is looking for the pot of gold at the end of the rainbow.



BEVIS ASSOCIATES INTERNATIONAL, INC.

"SPECIALISTS IN RESPIRATORY PROTECTION"

Date: _____

Initials: _____

PLEASE PRINT CLEARLY

TEST SUBJECT

NAME: _____

last

first

initial

EMPLOYER: _____

BADGE NO: _____ SOCIAL SECURITY NO: _____ - _____ - _____

½ MASK SELECTION

RESPIRATOR MAKE: _____ MODEL: _____ SIZE _____

RESPIRATOR MAKE: _____ MODEL: _____ SIZE _____

FULL FACE SELECTION

RESPIRATOR MAKE: _____ MODEL: _____ SIZE _____

RESPIRATOR MAKE: _____ MODEL: _____ SIZE _____

NOTES: _____



BEVIS ASSOCIATES INTERNATIONAL, INC.

"SPECIALISTS IN RESPIRATORY PROTECTION"

PLEASE PRINT CLEARLY

TEST SUBJECT NAME: _____
(last) (first) (initial)

EMPLOYER: _____ JOB TITLE: _____

BADGE NO.: _____ SOCIAL SECURITY NO.: _____

RESPIRATOR MAKE: _____ MODEL: _____ SIZE: _____

SENSITIVITY TEST: _____ DATE: _____ TIME: _____

TEST ATMOSPHERE: _____ NOTES: _____

TEST SUBJECT SIGNATURE

TEST EQUIPMENT OPERATOR

14640 FLINT LEE ROAD • SUITE D • CHANTILLY, VIRGINIA 22021 • (703) 378-0333 • FAX (703) 378-0336

MEMBERS: American Industrial Hygiene Association • American National Standards Institute



BEVIS ASSOCIATES INTERNATIONAL, INC.

"SPECIALISTS IN RESPIRATORY PROTECTION"

Fit Test Record

For use with the

TSI PORTACOUNT CNC TEST EQUIPMENT

PLEASE PRINT CLEARLY

TEST SUBJECT NAME: _____
(last) (first) (initial)

EMPLOYER: _____ JOB TITLE: _____

BADGE NO.: _____ SOCIAL SECURITY NO.: _____

RESPIRATOR MAKE: _____ MODEL: _____ SIZE: _____

FIT FACTOR: _____ DATE: _____ TIME: _____

PORTACOUNT SERIAL NO.: _____

PRINTER SERIAL NO.: _____

TEST SUBJECT SIGNATURE

TEST EQUIPMENT OPERATOR

Attach PortaCount
printout here
(ensure test sub-
ject's name is
also recorded on
back of printout)

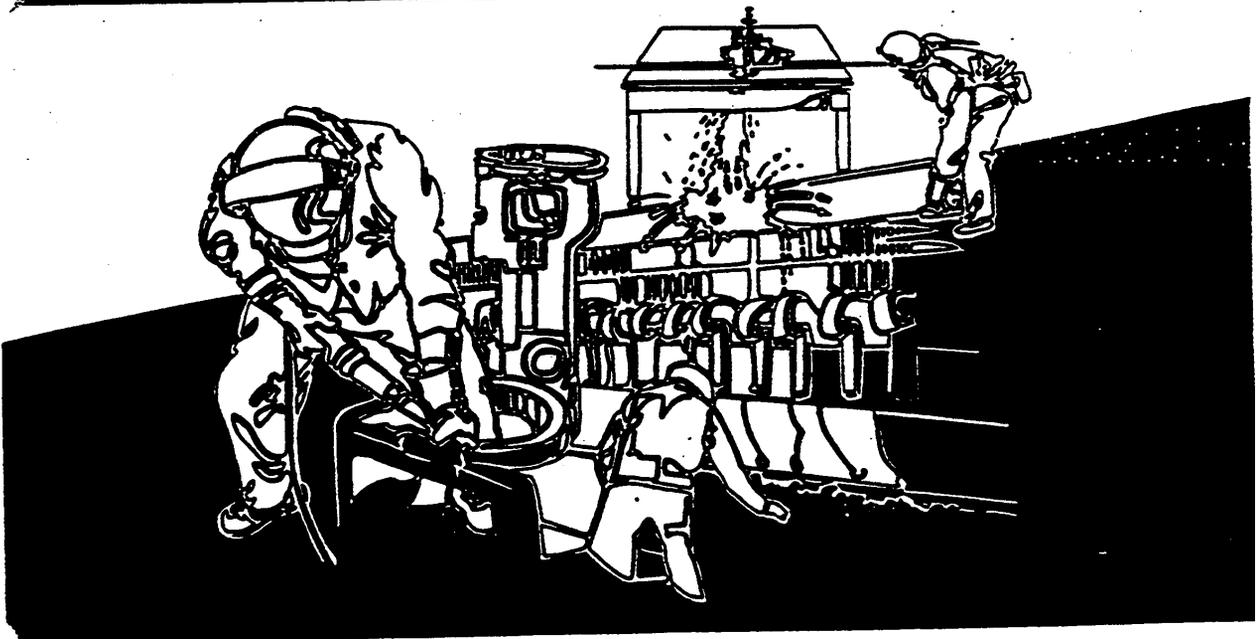
14640 FLINT LEE ROAD • SUITE D • CHANTILLY, VIRGINIA 22021 • (703) 378-0333 • FAX (703) 378-0336

MEMBERS: American Industrial Hygiene Association • American National Standards Institute



NIOSH HEALTH HAZARD EVALUATION REPORT

**HETA 93-040-2315
ANCHORAGE FIRE DEPARTMENT
ANCHORAGE, ALASKA**



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health



PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employer and authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to federal, state, and local agencies; labor; industry; and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

Mention of company names or products does not constitute endorsement by the National Institute for Occupational Safety and Health.

**HETA 93-040-2315
MAY 1993
ANCHORAGE FIRE DEPARTMENT
ANCHORAGE, ALASKA**

**NIOSH INVESTIGATORS:
STEVEN W. LENHART, CIH
G.E. BURROUGHS, CIH**

SUMMARY

The National Institute for Occupational Safety and Health (NIOSH) conducted a Health Hazard Evaluation (HHE) in response to a request from the Fire Chief of the Anchorage Fire Department. The HHE request was received after four fire fighters reported experiencing either skin irritation or eye irritation as a result of qualitative fit tests using irritant smoke. Each of 186 fire fighters from the Anchorage Fire Department were fit tested in 1992, while wearing a self-contained breathing apparatus (SCBA) (with nose cup) operated in the pressure-demand mode. The fit testing method used by Anchorage involved puffing irritant smoke from air flow indicator tubes into a test hood which encompassed the fire fighter's head and the SCBA's facepiece. The tubes used contain stannic chloride (SnCl_4), which reacts with ambient humidity to liberate a white hydrochloric acid fume and tin compounds. The health risks associated with the use of irritant smoke were evaluated by: (1) conducting particle size analysis of the "smoke" emitted from air flow indicator tubes, and (2) measuring the concentration of hydrogen chloride produced by these tubes. Count median diameters of the smoke ranged from 0.33 to 0.63 micrometer with geometric standard deviations ranging from 1.35 to 2.13. Concentrations of hydrogen chloride measured without the hood in place on a day with low (14%) relative humidity ranged from <1 part per million (ppm) to 2,700 ppm. The highest concentration measured inside the test hood was also 2,700 ppm; this value was achieved during multiple bulb squeezes. Concentrations of hydrogen chloride measured without the hood in place on a day with high (53%) relative humidity ranged from 100 ppm to 11,900 ppm. The highest concentration measured inside the test hood during multiple bulb squeezes was 14,400 ppm; individual bulb squeezes produced concentrations ranging from 1,200 ppm to 10,900 ppm.

Because fire fighting activities frequently occur in highly toxic atmospheres or those immediately dangerous to life or health, a quantitative fit test was recommended to be used by the Anchorage Fire Department. Fit tests were recommended to be conducted with the full facepiece air-purifying versions of the facepieces that are also used with the SCBAs used by the fire department. The sampling results of this study suggest that high concentrations of hydrogen chloride are emitted from irritant smoke tubes and that exposure to the fume produced by these tubes should be considered a health risk.

KEYWORDS: SIC 9224 (Fire Protection), fire fighting, hydrogen chloride, irritant smoke, respirator fit testing.

MATERIAL SAFETY DATA SHEET

EASTMAN KODAK COMPANY
343 State Street
Rochester, New York 14650

For Emergency Health, Safety, and Environmental Information, call 716-722-5151
For all other purposes, call 800-225-5352, in New York State call 716-458-4014

Date of Preparation: 04/13/87

Kodak Accession Number: 900298

SECTION I. IDENTIFICATION

- Product Name: Isopentyl Acetate
- Synonym(s): 3-Methyl-1-butanol Acetate
- Formula: C7 H14 O2
- CAT No(s): 104 5269; 104 5285; 815 1524; 841 1746
- Chem. No(s): 00298
- Kodak's Internal Hazard Rating Codes: R: 2 S: 2 F: 3 C: 0

SECTION II. PRODUCT AND COMPONENT HAZARD DATA

COMPONENT(S):	Percent	ACGIH TLV(R)	CAS Reg. No.
Isopentyl Acetate	ca. 100	100 ppm	123-92-2

SECTION III. PHYSICAL DATA

- Appearance and Odor: Colorless liquid; banana-like odor
- Boiling Point: 140 C (284 F)
- Vapor Pressure: 4 mmHg at 20 C (68 F)
- Evaporation Rate (n-butyl acetate = 1): Not Available
- Volatile Fraction by Weight: ca. 100 %
- Specific Gravity (Water = 1): 0.87
- Solubility in Water (by Weight): Slight

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

- Flash Point: 25 C (77 F) Setflash closed cup
- Extinguishing Media: Water spray; Dry chemical; Carbon dioxide; Foam
- Special Fire Fighting Procedures: Wear self-contained breathing apparatus and protective clothing. USE WATER WITH CAUTION. Since this material is lighter than water and only slightly soluble in water, the fire could easily be spread by the use of water in an area where the water could not be contained. Water may be ineffective in fighting fire. Use water spray to keep fire-exposed containers cool.
- Unusual Fire and Explosion Hazards: Vapors are heavier than air and may travel along the ground or be moved by ventilation to an ignition source and flash back.

R-0213.700A

87-8275

SECTION V. REACTIVITY DATA

- Stability: Stable
- Incompatibility: Strong oxidizers
- Hazardous Decomposition Products: Combustion will produce carbon dioxide and probably carbon monoxide.
- Hazardous Polymerization: Will not occur.

SECTION VI. TOXICITY AND HEALTH HAZARD DATA

- A. EXPOSURE LIMITS: TLV 100 ppm TWA, STEL 125 ppm (proposed deletion), ACGIH 1986-87. The OSHA PEL is 150 ppm.
- B. EXPOSURE EFFECTS:
Inhalation: Vapor irritating. Causes narcosis, headache, dizziness and loss of consciousness in high concentrations.
Skin: May cause irritation.
Eye: May cause irritation.
Ingestion: Low hazard for usual handling.
- C. FIRST AID:
Inhalation: Remove to fresh air. Treat symptomatically. If symptoms are present get medical attention.
Skin: Immediately flush skin with plenty of water. Get medical attention if symptoms are present after washing.
Eye: Immediately flush eyes with plenty of water for at least 15 minutes and get medical attention.
Ingestion: Drink 1-2 glasses of milk or water and induce vomiting. Call a physician immediately.

SECTION VII. VENTILATION AND PERSONAL PROTECTION

- A. VENTILATION:
Good general room ventilation should be used. Local exhaust may be needed.
- B. RESPIRATORY PROTECTION:
A NIOSH approved organic vapor respirator should be worn, if needed.
- C. SKIN AND EYE PROTECTION:
Protective gloves and clothing should be worn. Safety glasses should be worn.

SECTION VIII. SPECIAL STORAGE AND HANDLING PRECAUTIONS

Keep from contact with oxidizing materials.
Classified as a flammable liquid. Keep away from heat, sparks and flame.
Use with adequate ventilation. Keep container closed.
Comply with all federal, state and local codes pertaining to the storage, handling, dispensing and disposal of flammable liquids.

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87-8275

SECTION IX. SPILL, LEAK, AND DISPOSAL PROCEDURES

Remove all sources of ignition. Absorb material in vermiculite or other suitable absorbent and place in impervious container. Dispose by incineration or contract with licensed chemical waste disposal agency. Discharge, treatment, or disposal may be subject to federal, state or local laws.

For transportation information regarding this product, please phone the Eastman Kodak Distribution Center nearest you: Rochester, NY (716) 254-1300; Oak Brook, IL (312) 654-5300; Chamblee, GA (404) 455-0123; Dallas, TX (214) 241-1611; Whittier, CA (213) 945-1255; Honolulu, HI (808) 833-1661.

The information contained herein is furnished without warranty of any kind. Users should consider these data only as a supplement to other information gathered by them and must make independent determinations of the suitability and completeness of information from all sources to assure proper use and disposal of these materials and the safety and health of employees and customers.

R-0213.700A

87-8275

@900298*

Name:
Next Test Date: 10/17/91

TSI MODEL 8015 PORTACOUNT FIT-TESTING SOFTWARE
Version 2.01 S/N

FIT TEST REPORT

Test Date: 10-17-1990
Test Time: 2:45:50 pm
Test subject last name:
Test subject first name:
ID number: 1234
Operator name: BRUTSCHE
Next fit test due: 10/17/91
Test agent: Ambient particles
Test device: TSI MODEL 8010 PORTACOUNT

RESPIRATOR ID

Size: MEDIUM
Model: 7700
Manufacturer: NORTH
Approval number: TC-21C-152

Additional notes: TWO DAY STUBBLE
Additional notes: RESPIRATORY PROTECTION CLASS, COLUMBUS

TEST DATA

Pass/Fail level: 100
Test cycles: 1

Ex.	Ambient (Part/cc)	Mask (Part/cc)	Fit Factor	Pass/Fail
NB	10500	1.450	7270	PASS
DB	10650	15.600	683	PASS
SS	10450	88.400	118	PASS
UD	10350	2.990	3470	PASS
R	10650	65.300	163	PASS
NB	10650	1.240	8620	PASS

OVERALL FIT FACTOR = 361 PASS
(Calculated per ANSI Z88.2-1980)

Operator _____ Date _____

Test Subject _____ Date _____

Name:
Next Test Date: 10/18/91

TSI MODEL 8015 PORTACOUNT FIT-TESTING SOFTWARE
Version 2.01 S/N

FIT TEST REPORT

Test Date: 10-18-1990
Test Time: 10:11:15 am
Test subject last name:
Test subject first name:
ID number: 1234
Operator name: BRUTSCHE
Next fit test due: 10/18/91
Test agent: Ambient particles
Test device: TSI MODEL 8010 PORTACOUNT

RESPIRATOR ID

Size: MEDIUM
Model: 7700
Manufacturer: NORTH
Approval number: TC-21C-152

Additional notes: CLEAN SHAVEN
Additional notes: RESPIRATORY PROTECTION CLASS, COLUMBUS

TEST DATA

Pass/Fail level: 100
Test cycles: 1

Ex.	Ambient (Part/cc)	Mask (Part/cc)	Fit Factor	Pass/Fail
NB	10380	0.180	57700	PASS
DB	11150	3.320	3370	PASS
SS	11100	0.020	557000	PASS
UD	11000	0.020	551000	PASS
R	11000	7.590	1450	PASS
NB	11300	0.540	21000	PASS

OVERALL FIT FACTOR = 5687 PASS
(Calculated per ANSI Z88.2-1980)

Operator _____ Date _____

Test Subject _____ Date _____

Name:
Next Test Date: 02/05/92

TSI MODEL 8015 PORTACOUNT FIT-TESTING SOFTWARE
Version 2.01 S/N

FIT TEST REPORT

Test Date: 02-05-1991
Test Time: 5:24:31 pm
Test subject last name:
Test subject first name:
ID number:
Operator name: Morris
Next fit test due: 2/5/92
Test agent: Ambient particles
Test device: TSI MODEL 8010 PORTACOUNT

RESPIRATOR ID

Size: Large
Model: Half mask
Manufacturer: Survivair
Approval number:

Additional notes: Medium whiskers, 3 days growth
Additional notes: Respiratory Protection Class

TEST DATA

Pass/Fail level: 100
Test cycles: 1

Ex.	Ambient (Part/cc)	Mask (Part/cc)	Fit Factor	Pass/Fail
NB	13850	69.300	200	PASS
DB	13200	24.900	529	PASS
SS	12400	2.520	4930	PASS
UD	12700	2730	4.7	FAIL
R	12500	9.370	1340	PASS
NB	12550	7.080	1780	PASS

OVERALL FIT FACTOR = 27.0 FAIL
(Calculated per ANSI Z88.2-1980)

Operator _____ Date _____

Test Subject _____ Date _____

Name:
Next Test Date: 2/7/92

TSI MODEL 8015 PORTACOUNT FIT-TESTING SOFTWARE
Version 2.01 S/N

FIT TEST REPORT

Test Date: 2-7-1991
Test Time: 8:15:18 am
Test subject last name:
Test subject first name:
ID number:
Operator name: Brutsche
Next fit test due: 2/7/91
Test agent: Ambient particles
Test device: TSI MODEL 8010 PORTACOUNT

RESPIRATOR ID

Size: Large
Model: Half mask
Manufacturer: SurvivAir
Approval number:

Additional notes: Clean shaven
Additional notes: Respiratory Protection Class

TEST DATA

Pass/Fail level: 100
Test cycles: 1

Ex.	Ambient (Part/cc)	Mask (Part/cc)	Fit Factor	Pass/Fail
NB	13450	0.220	61200	PASS
DB	13350	0.420	31800	PASS
SS	12850	0.050	258000	PASS
UD	12550	0.070	180000	PASS
R	12100	0.880	13800	PASS
NB	11600	0.070	166000	PASS

OVERALL FIT FACTOR = 44213 PASS
(Calculated per ANSI Z88.2-1980)

Operator _____ Date _____

Test Subject _____ Date _____

Small Entity Compliance Guide
APPENDIX IV
Small Entity Compliance Guide:
Sample Respiratory Protection Program

Small Entity Compliance Guide

APP IV-2

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Small Entity Compliance Guide:
Sample Respiratory Protection Program

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Small Entity Compliance Guide

This Sample Respiratory Protection Program is for demonstration purposes only. XYZ Seating is not intended to represent an actual company. XYZ is a hypothetical company that has chosen to interpret certain provisions of 29 CFR 1910.134 in ways that could be different from the way another company might choose to implement it.

APP IV-3

1.0 Purpose

XYZ Seating has determined that employees in the Prep, Coating, Assembly, and Maintenance departments are exposed to respiratory hazards during routine operations. These hazards include wood dust, particulates, and vapors, and in some cases represent Immediately Dangerous to Life or Health (IDLH) conditions. The purpose of this program is to ensure that all XYZ Seating employees are protected from exposure to these respiratory hazards.

Engineering controls, such as ventilation and substitution of less toxic materials, are the first line of defense at XYZ Seating; however, engineering controls have not always been feasible for some of our operations, or have not always completely controlled the identified hazards. In these situations, respirators and other protective equipment must be used. Respirators are also needed to protect employees' health during emergencies. The work processes requiring respirator use at XYZ Seating are outlined in Table 1 in the Scope and Application section of this program.

In addition, some employees have expressed a desire to wear respirators during certain operations that do not require respiratory protection. As a general policy XYZ Seating will review each of these requests on a case-by-case basis. If the use of respiratory protection in a specific case will not jeopardize the health or safety of the worker(s), XYZ Seating will provide respirators for voluntary use. As outlined in the Scope and Application section of this program, voluntary respirator use is subject to certain requirements of this program.

2.0 Scope and Application

This program applies to all employees who are required to wear respirators during normal work operations, and during some non-routine or emergency operations such as a spill of a hazardous substance. This includes employees in the Prep, Coating (Spray Booth), Assembly, and Maintenance departments. All employees working in these areas and engaged in certain processes or tasks (as outlined in the table below) must be enrolled in the company's respiratory protection program.

In addition, any employee who voluntarily wears a respirator when a respirator is not required (i.e., in certain maintenance and coating operations) is subject to the medical evaluation, cleaning, maintenance, and storage elements of this program, and must be provided with certain information specified in this section of the program.¹

1. Employees who voluntarily wear filtering facepieces (dust masks) are not subject to the medical evaluation, cleaning, storage, and maintenance provisions of this program.

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Employees participating in the respiratory protection program do so at no cost to them. The expense associated with training, medical evaluations and respiratory protection equipment will be borne by the company.

Respirator	<i>Department/Process</i>
Filtering facepiece (dust mask)	Voluntary use for warehouse workers
Half-facepiece APR or PAPR with P100 filter	Prep and Assembly Voluntary use for maintenance workers when cleaning spray booth walls or changing spray booth filter
SAR, pressure demand, with auxiliary SCBA	Maintenance - dip coat tank cleaning
Continuous flow SAR with hood	Spray booth operations Prep (cleaning)*
Half-facepiece APR with organic vapor cartridge	Voluntary use for Dip Coat Tenders, Spray Booth Operators (gun cleaning), and Maintenance workers (loading coating agents into supply systems)
Escape SCBA	Dip Coat, Coatings Storage Area, Spray Booth Cleaning Area

* until ventilation is installed.

3.0 Responsibilities

Program Administrator

The Program Administrator is responsible for administering the respiratory protection program. Duties of the program administrator include:

- Identifying work areas, processes or tasks that require workers to wear respirators, and evaluating hazards.
- Selection of respiratory protection options.
- Monitoring respirator use to ensure that respirators are used in accordance with their certifications.
- Arranging for and/or conducting training.
- Ensuring proper storage and maintenance of respiratory protection equipment.

- Conducting qualitative fit testing with Bitrex.
- Administering the medical surveillance program.
- Maintaining records required by the program.
- Evaluating the program.
- Updating written program, as needed.

The Program Administrator for Company XYZ Seating is _____.

Supervisors

Supervisors are responsible for ensuring that the respiratory protection program is implemented in their particular areas. In addition to being knowledgeable about the program requirements for their own protection, supervisors must also ensure that the program is understood and followed by the employees under their charge. Duties of the supervisor include:

- Ensuring that employees under their supervision (including new hires) have received appropriate training, fit testing, and annual medical evaluation.
- Ensuring the availability of appropriate respirators and accessories.
- Being aware of tasks requiring the use of respiratory protection.
- Enforcing the proper use of respiratory protection when necessary.
- Ensuring that respirators are properly cleaned, maintained, and stored according to the respiratory protection plan.
- Ensuring that respirators fit well and do not cause discomfort.
- Continually monitoring work areas and operations to identify respiratory hazards.
- Coordinating with the Program Administrator on how to address respiratory hazards or other concerns regarding the program.

Employees

Each employee has the responsibility to wear his or her respirator when and where required and in the manner in which they were trained. Employees must also:

- Care for and maintain their respirators as instructed, and store them in a clean sanitary location.
- Inform their supervisor if the respirator no longer fits well, and request a new one that fits properly.
- Inform their supervisor or the Program Administrator of any respiratory hazards that they feel are not adequately addressed in the workplace and of any other concerns that they have regarding the program.

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4.0 Program Elements

Selection Procedures

The Program Administrator will select respirators to be used on site, based on the hazards to which workers are exposed and in accordance with all OSHA standards. The Program Administrator will conduct a hazard evaluation for each operation, process, or work area where airborne contaminants may be present in routine operations or during an emergency. The hazard evaluation will include:

- 1) Identification and development of a list of hazardous substances used in the workplace, by department, or work process.
- 2) Review of work processes to determine where potential exposures to these hazardous substances may occur. This review shall be conducted by surveying the workplace, reviewing process records, and talking with employees and supervisors.
- 3) Exposure monitoring to quantify potential hazardous exposures. Monitoring will be contracted out. XYZ Seating currently has a contract with ABC Industrial Hygiene Services to provide monitoring when needed.

The results of the current hazard evaluation are the following:

(Table 3 at the end of this program contains the sampling data that this section was based on.)

Prep-sanding: Ventilation controls on some sanders are in place, but employees continue to be exposed to respirable wood dust at 2.5 - 7.0 mg/m³ (8-hour time-weighted-average, or TWA). Half-facepiece APRs with P100 filters and goggles are required for employees sanding wood pieces. PAPRs will be available for employees who are unable to wear an APR.

Prep-cleaning: Average methylene chloride exposures measured at 70 ppm based on 8 hr. TWA exposure results for workers cleaning/stripping furniture pieces. Ventilation controls are planned, but will not be implemented until designs are completed and a contract has been let for installation of the controls. In the meantime, employees must wear supplied air hoods with continuous airflow, as required by the Methylene Chloride standard 1910.1052.

Coating-spray booth: XYZ Seating has decided to take a conservative approach and require all employees to wear supplied air respirators when working inside the spray booth. Based on exposure data in published reports on the same type of spray booth operations, the Program Administrator has determined that an SAR in the continuous flow mode will provide sufficient protection. Spray booth employees may opt to wear half-facepiece APRs with organic vapor cartridges when cleaning spray guns.

Coating-dip coat, and drying: Exposures are kept within PELs by ventilation, and employees generally enter the dip coat area for short time periods (up to one hour). Vapors could leak into the dip coat and drying areas if the ventilation system is not running at peak efficiency. Odors in this area are often unpleasant even at the levels maintained by the ventilation system. While XYZ Seating notes that respiratory protection is not required in this area, the company recognizes employee concern about breathing vapors and about having to work in an unpleasant environment. Accordingly, employees may voluntarily choose to wear a half-facepiece APR with organic vapor cartridges when working in this area.

Assembly: Ventilation controls on sanders are in place, but employees continue to be exposed to respirable wood dust at 2.5 - 6.0 mg/m³ (8 hour TWA); half-facepiece APRs with P100 filters and goggles are required for employees sanding wood pieces in the assembly department. PAPRs will be available for employees who are unable to wear an APR. The substitution for aqueous-based glues will eliminate exposures to formaldehyde, methylene chloride, and epoxy resins.

Maintenance: Because of potential IDLH conditions, employees cleaning dip coat tanks must wear a pressure demand SAR during the performance of this task.

Employees may voluntarily wear half-facepiece APRs with P100 cartridges when cleaning spray booth walls or changing booth filters and half-facepiece APRs with organic vapor cartridges when loading coating agents into supply systems. Although exposure monitoring has shown that exposures are kept within PELs during these procedures, XYZ Seating will provide respirators to workers who are concerned about potential exposures.

Updating the Hazard Assessment

The Program Administrator must revise and update the hazard assessment as needed (i.e., any time work process changes may potentially affect exposure). If an employee feels that respiratory protection is needed during a particular activity, he/she is to contact his or her supervisor or the Program Administrator. The Program Administrator will evaluate the potential hazard, arranging for outside assistance as necessary. The Program Administrator will then communicate the results of that assessment back to the employees. If it is determined that respiratory protection is necessary, all other elements of this program will be in effect for those tasks and this program will be updated accordingly.

NIOSH Certification

All respirators must be certified by the National Institute for Occupational Safety and Health (NIOSH) and shall be used in accordance with the terms of that certification. Also, all filters, cartridges, and canisters must be labeled with the appropriate NIOSH approval label. The label must not be removed or defaced while it is in use.

Voluntary Respirator Use

XYZ Seating will provide respirators at no charge to employees for voluntary use for the following work processes:

- Employees may wear half-facepiece APRs with organic vapor cartridges while working in the dip coat area.
- Warehouse workers may wear filtering facepieces.
- Spray Booth Operators may wear half-facepiece APRs with organic vapor cartridges while cleaning spray guns.
- Maintenance personnel may wear half-facepiece APRs with P100 cartridges while cleaning spray booth walls, and organic vapor cartridges while loading spray guns.

The Program Administrator will provide all employees who voluntarily choose to wear either of the above respirators with a copy of Appendix D of the standard. (Appendix D details the requirements for voluntary use of respirators by employees.) Employees choosing to wear a half facepiece APR must comply with the procedures for Medical Evaluation, Respirator Use, and Cleaning, Maintenance and Storage.

The Program Administrator shall authorize voluntary use of respiratory protective equipment as requested by all other workers on a case-by-case basis, depending on specific workplace conditions and the results of the medical evaluations.

Medical Evaluation

Employees who are either required to wear respirators, or who choose to wear an APR voluntarily, must pass a medical exam before being permitted to wear a respirator on the job. Employees are not permitted to wear respirators until a physician has determined that they are medically able to do so. Any employee refusing the medical evaluation will not be allowed to work in an area requiring respirator use.

A licensed physician at ABC medical clinic, where all company medical services are provided, will provide the medical evaluations. Medical evaluation procedures are as follows:

- The medical evaluation will be conducted using the questionnaire provided in Appendix C of the respiratory protection standard. The Program Administrator will provide a copy of this questionnaire to all employees requiring medical evaluations.

- To the extent feasible, the company will assist employees who are unable to read the questionnaire (by providing help in reading the questionnaire). When this is not possible, the employee will be sent directly to the physician for medical evaluation.
- All affected employees will be given a copy of the medical questionnaire to fill out, along with a stamped and addressed envelope for mailing the questionnaire to the company physician. Employees will be permitted to fill out the questionnaire on company time.
- Follow-up medical exams will be granted to employees as required by the standard, and/or as deemed necessary by the ABC medical clinic physician.
- All employees will be granted the opportunity to speak with the physician about their medical evaluation, if they so request.
- The Program Administrator has provided the ABC medical clinic physician with a copy of this program, a copy of the Respiratory Protection standard, the list of hazardous substances by work area, and for each employee requiring evaluation: his or her work area or job title, proposed respirator type and weight, length of time required to wear respirator, expected physical work load (light, moderate, or heavy), potential temperature and humidity extremes, and any additional protective clothing required.
- Any employee required for medical reasons to wear a positive pressure air-purifying respirator will be provided with a powered air-purifying respirator.
- After an employee has received clearance and begun to wear his or her respirator, additional medical evaluations will be provided under the following circumstances:
 - Employee reports signs and/or symptoms related to their ability to use a respirator, such as shortness of breath, dizziness, chest pains, or wheezing.
 - The ABC medical clinic physician or supervisor informs the Program Administrator that the employee needs to be reevaluated;
 - Information from this program, including observations made during fit testing and program evaluation, indicates a need for reevaluation;
 - A change occurs in workplace conditions that may result in an increase physiological burden on the employee.

A list of XYZ Seating employees currently included in medical surveillance is provided in Table 2 of this program.

All examinations and questionnaires are to remain confidential between the employee and the physician.

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Fit Testing

Fit testing is required for employees wearing half-facepiece APRs for exposure to wood dust in Prep and Assembly, and maintenance workers who wear a tight-fitting SAR for dip tank cleaning. Employees voluntarily wearing half-facepiece APRs may also be fit tested upon request.

Employees who are required to wear half-facepiece APRs will be fit tested:

- Prior to being allowed to wear any respirator with a tight fitting facepiece.
- Annually.
- When there are changes in the employee's physical condition that could affect respiratory fit (e.g., obvious change in body weight, facial scarring, etc.).

Employees will be fit tested with the make, model, and size of respirator that they will actually wear. Employees will be provided with several models and sizes of respirators so that they may find an optimal fit. Fit testing of PAPRs is to be conducted in the negative pressure mode.

The Program Administrator will conduct fit tests following the OSHA approved Bitrex Solution Aerosol QLFT Protocol in Appendix B (B4) of the Respiratory Protection standard.

The Program Administrator has determined that QNFT is not required for the respirators used under current conditions at XYZ Seating. If conditions affecting respirator use change, the Program Administrator will evaluate on a case-by-case basis whether QNFT is required.

Respirator Use

Respiratory protection is required for the following personnel:

Name	Department	Job Description/ Work Procedure	Respirator
Joe Apple	Prep	Operator	Half mask APR P100 filter when sanding/ SAR continuous flow hood for cleaning
Ron Carey	Maintenance	Dip tank cleaning	SAR, pressure demand with auxiliary SCBA
Lisa Jones	Coating Spray Booth	Operator	SAR, continuous flow hood

General Use Procedures:

- Employees will use their respirators under conditions specified by this program, and in accordance with the training they receive on the use of each particular model. In addition, the respirator shall not be used in a manner for which it is not certified by NIOSH or by its manufacturer.
- All employees shall conduct user seal checks each time that they wear their respirator. Employees shall use either the positive or negative pressure check (depending on which test works best for them) specified in Appendix B-1 of the Respiratory Protection Standard.
- All employees shall be permitted to leave the work area to go to the locker room to maintain their respirator for the following reasons: to clean their respirator if the respirator is impeding their ability to work, change filters or cartridges, replace parts, or to inspect respirator if it stops functioning as intended. Employees should notify their supervisor before leaving the area.

_ Employees are not permitted to wear tight-fitting respirators if they have any condition, such as facial scars, facial hair, or missing dentures, that prevents them from achieving a good seal. Employees are not permitted to wear headphones, jewelry, or other articles that may interfere with the facepiece-to-face seal.

Emergency Procedures:

The following work areas have been identified as having foreseeable emergencies:

Spray Booth Cleaning Area - spill of hazardous waste
Dip Coat Area - malfunction of ventilation system, leak in supply system
Coatings Storage Area - spill or leak of hazardous substances

When the alarm sounds, employees in the affected department must immediately don their emergency escape respirator, shut down their process equipment, and exit the work area. All other employees must immediately evacuate the building. XYZ Seating's Emergency Action Plan describes these procedures (including proper evacuation routes and rally points) in greater detail.

Emergency escape respirators are located:

Locker #1 in the Spray Booth Area
Storage cabinet #3 in Dip Coat/Drying Area
Locker #4 in the Coatings Storage Area

Respiratory protection in these instances is for escape purposes only. XYZ Seating employees are not trained as emergency responders, and are not authorized to act in such a manner.

Respirator Malfunction

1. APR Respirator Malfunction:

For any malfunction of an APR (e.g., such as breakthrough, facepiece leakage, or improperly working valve), the respirator wearer should inform his or her supervisor that the respirator no longer functions as intended, and go to the designated safe area to maintain the respirator. The supervisor must ensure that the employee receives the needed parts to repair the respirator, or is provided with a new respirator.

2. Atmosphere-supplying Respirator Malfunction:

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All workers wearing atmosphere-supplying respirators will work with a buddy. Buddies shall assist workers who experience an SAR malfunction as follows:

If a worker in the spray booth experiences a malfunction of an SAR, he or she should signal to the buddy that he or she has had a respirator malfunction. The buddy shall don an emergency escape respirator and aid the worker in immediately exiting the spray booth.

Workers cleaning wood pieces or assembled furniture in the Prep department will work with a buddy. If one of the workers experiences a respirator malfunction, he/she shall signal this to their buddy. The buddy must immediately stop what he or she is doing to escort the employee to the Prep staging area where the employee can safely remove the SAR.

IDLH Procedures

The Program Administrator has identified the following area as presenting the potential for IDLH conditions:

Dip Coat Tank Cleaning:

Maintenance workers will be periodically required to enter the dip tank to perform scheduled or unscheduled maintenance. In such cases, workers will follow the permit required confined space entry procedures specified in the XYZ Seating Confined Space Program. As specified in these procedures, the Program Administrator has determined that workers entering this area shall wear a pressure demand SAR. In addition, an appropriately trained and equipped standby person shall remain outside the dip tank and maintain constant voice and visual communication with the worker. In the event of an emergency requiring the standby person to enter the IDLH environment, the standby person shall immediately notify the Program Administrator and will proceed with rescue operations in accordance with rescue procedures outlined in the XYZ Seating Confined Space Program.

Air Quality

For supplied-air respirators, only Grade D breathing air shall be used in the cylinders. The Program Administrator will coordinate deliveries of compressed air with the company's vendor, Compressed Air Inc., and require Compressed Air Inc. to certify that the air in the cylinders meets the specifications of Grade D breathing air.

The Program Administrator will maintain a minimum air supply of one fully charged replacement cylinder for each SAR unit. In addition, cylinders may be recharged as necessary from the breathing air cascade system located near the respirator storage area. The air for this

system is provided by XYZ Seating's supplier, and deliveries of new air are coordinated by the Program Administrator.

Cleaning, Maintenance, Change Schedules and Storage

Cleaning

Respirators are to be regularly cleaned and disinfected at the designated respirator cleaning station located in the employee locker room.

Respirators issued for the exclusive use of an employee shall be cleaned as often as necessary, but at least once a day for workers in the Prep and Assembly departments.

Atmosphere supplying and emergency use respirators are to be cleaned and disinfected after each use.

The following procedure is to be used when cleaning and disinfecting respirators:

- Disassemble respirator, removing any filters, canisters, or cartridges.
- Wash the facepiece and associated parts in a mild detergent with warm water. Do not use organic solvents.
- Rinse completely in clean warm water.
- Wipe the respirator with disinfectant wipes (70% Isopropyl Alcohol) to kill germs.
- Air-dry in a clean area.
- Reassemble the respirator and replace any defective parts.
- Place in a clean, dry plastic bag or other airtight container.

Note: The Program Administrator will ensure an adequate supply of appropriate cleaning and disinfecting material at the cleaning station. If supplies are low, employees should contact their supervisor, who will inform the Program Administrator.

Maintenance

Respirators are to be properly maintained at all times in order to ensure that they function properly and adequately protect the employee. Maintenance involves a thorough visual inspection for cleanliness and defects. Worn or deteriorated parts will be replaced prior to use. No components will be replaced or repairs made beyond those recommended by the manufacturer. Repairs to regulators or alarms of atmosphere-supplying respirators will be conducted by the manufacturer.

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The following checklist will be used when inspecting respirators:

- Facepiece:
 - cracks, tears, or holes
 - facemask distortion
 - cracked or loose lenses/faceshield

- Headstraps:
 - breaks or tears
 - broken buckles

- Valves:
 - residue or dirt
 - cracks or tears in valve material

- Filters/Cartridges:
 - approval designation
 - gaskets
 - cracks or dents in housing
 - proper cartridge for hazard

- Air Supply Systems:
 - breathing air quality/grade
 - condition of supply hoses
 - hose connections
 - settings on regulators and valves

Employees are permitted to leave their work area to perform limited maintenance on their respirator in a designated area that is free of respiratory hazards. Situations when this is permitted include to wash their face and respirator facepiece to prevent any eye or skin irritation, to replace the filter, cartridge or canister, and if they detect vapor or gas breakthrough or leakage in the facepiece or if they detect any other damage to the respirator or its components.

Change Schedules

Employees wearing APRs or PAPRs with P100 filters for protection against wood dust and other particulates shall change the cartridges on their respirators when they first begin to experience difficulty breathing (i.e., resistance) while wearing their masks.

Based on discussions with our respirator distributor about XYZ Seating's workplace exposure conditions, employees voluntarily wearing APRs with organic vapor cartridges shall change

the cartridges on their respirators at the end of each workweek to ensure the continued effectiveness of the respirators.

Storage

Respirators must be stored in a clean, dry area, and in accordance with the manufacturer's recommendations. Each employee will clean and inspect their own air-purifying respirator in accordance with the provisions of this program and will store their respirator in a plastic bag in their own locker. Each employee will have his/her name on the bag and that bag will only be used to store that employee's respirator.

Atmosphere supplying respirators will be stored in the storage cabinet outside of the Program Administrator's office.

The Program Administrator will store XYZ's supply of respirators and respirator components in their original manufacturer's packaging in the equipment storage room.

Defective Respirators

Respirators that are defective or have defective parts shall be taken out of service immediately. If, during an inspection, an employee discovers a defect in a respirator, he/she is to bring the defect to the attention of his or her supervisor. Supervisors will give all defective respirators to the Program Administrator. The Program Administrator will decide whether to:

- Temporarily take the respirator out of service until it can be repaired.
- Perform a simple fix on the spot such as replacing a headstrap.
- Dispose of the respirator due to an irreparable problem or defect.

When a respirator is taken out of service for an extended period of time, the respirator will be tagged out of service, and the employee will be given a replacement of similar make, model, and size. All tagged out respirators will be kept in the storage cabinet inside the Program Administrator's office.

Training

The Program Administrator will provide training to respirator users and their supervisors on the contents of the XYZ Seating Respiratory Protection Program and their responsibilities under it, and on the OSHA Respiratory Protection standard. Workers will be trained prior to using a respirator in the workplace. Supervisors will also be trained prior to using a respirator in the workplace or prior to supervising employees that must wear respirators.

The training course will cover the following topics:

- the XYZ Seating Respiratory Protection Program
- the OSHA Respiratory Protection standard
- respiratory hazards encountered at XYZ Seating and their health effects
- proper selection and use of respirators
- limitations of respirators
- respirator donning and user seal (fit) checks
- fit testing
- emergency use procedures
- maintenance and storage
- medical signs and symptoms limiting the effective use of respirators

Employees will be retrained annually or as needed (e.g., if they change departments and need to use a different respirator). Employees must demonstrate their understanding of the topics covered in the training through hands-on exercises and a written test. Respirator training will be documented by the Program Administrator and the documentation will include the type, model, and size of respirator for which each employee has been trained and fit tested.

5.0 Program Evaluation

The Program Administrator will conduct periodic evaluations of the workplace to ensure that the provisions of this program are being implemented. The evaluations will include regular consultations with employees who use respirators and their supervisors, site inspections, air monitoring and a review of records.

Problems identified will be noted in an inspection log and addressed by the Program Administrator. These findings will be reported to XYZ Seating management, and the report will list plans to correct deficiencies in the respirator program and target dates for the implementation of those corrections.

6.0 Documentation and Recordkeeping

A written copy of this program and the OSHA standard is kept in the Program Administrator's office and is available to all employees who wish to review it. Also maintained in the Program Administrator's office are copies of training and fit test records. These records will be updated as new employees are trained, as existing employees receive refresher training, and as new fit tests are conducted.

The Program Administrator will also maintain copies of the medical records for all employees covered under the respirator program. The completed medical questionnaire and the physician's documented findings are confidential and will remain at ABC Medical Clinic. The company will only retain the physician's written recommendation regarding each employee's ability to wear a respirator.

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TABLE 3: XYZ SEATING HAZARD ASSESSMENT - JUNE 1998

Department	Contaminants	Exposure Level (8 hrs TWA)*	PEL	Controls
Prep: Sanding	wood dust	2.5 - 7.0 mg/m ³	5 mg/ m ³ (TLV = 1 mg/m ³)	Local exhaust ventilation (LEV) for sanders. Half-facepiece APR with P100filter.
Prep: Cleaning	methylene chloride	70 ppm	25 ppm 125 ppm = STEL	LEV to be installed for cleaning stations. Continuous flow SAR hood until then needed for respiratory protection. Will reevaluate after LEV installation.
	methanol	150 ppm	200 ppm	
	acetone	400 ppm	1,000 ppm	
Coating: Spray booth painting	toluene	(300 ppm)**	200 ppm 500 ppm = 10 min peak	Continuous flow SAR hood
	xylene	(40 ppm)**	100 ppm 150 ppm = STEL	
	MEK (methyl ethyl ketone)	(25 ppm)**	200 ppm	
	methanol	(20 ppm)**	200 ppm	

Department	Contaminants	Exposure Level (8 hrs TWA)*	PEL	Controls
Coating: Spray booth gun cleaning	toluene	80 ppm (30 min)	200 ppm 500 ppm = 10 min peak	Half- facepiece APR with organic vapor cartridge
	methanol	300 ppm (30 min)	200 ppm	
Coating: Dip Coat	toluene	25 ppm	200 ppm 500 ppm = 10 min peak	Automated line is vented. Workers may voluntarily wear half- facepiece APR with organic vapor cartridge.
	xylene	50 ppm	100 ppm 150 ppm = STEL	
	MEK	60 ppm	200 ppm	
	MIBK	10 ppm	100 ppm	
	methanol	50 ppm	200 ppm	
Drying (oven)	None (monitoring revealed no significant exposures)	NA	NA	NA

Department	Contaminants	Exposure Level (8 hrs TWA)*	PEL	Controls
Assembly: sanding, gluing and nailing	wood dust formaldehyde epichlorohydrin methylene chloride	2.5 -6.0 mg/m ³ 1.0 ppm 4 ppm 60 ppm	5 mg/m ³ (TLV = 1 mg/m ³) 0.75 ppm 2 ppm = STEL 5 ppm 25 ppm 125 ppm = STEL	aqueous- based glues will be used to eliminate exposures to methylene chloride, formaldehyde and epichlorohydrin
Maintenance: Dip tank cleaning	toluene, xylene, MEK, MIBK, methanol	IDLH conditions		SAR, pressure demand with auxiliary SCBA must be worn
Maintenance: Spray booth cleaning/ filter change	particulates	1.8 mg/m ³	5 mg/m ³	Voluntary use, half-facepiece APR with P100 filter

Department	Contaminants	Exposure Level (8 hrs TWA)*	PEL	Controls
Maintenance: Loading coatings into supply systems	toluene	40 ppm (1 hr)	200 ppm 500 ppm = 10 min peak	Voluntary use, half-facepiece APR with organic vapor cartridges
	xylene	80 ppm (1 hr)	100 ppm 150 ppm = STEL	
	MEK	100 ppm (1 hr)	200 ppm	
	MIBK	15 ppm (1 hr)	100 ppm	
	methanol	125 ppm (1 hr)	200 ppm	
Warehouse	None	NA	NA	NA

* Summarized from Industrial Hygiene report provided by ABC Industrial Hygiene Services

** These values were obtained from a survey on average exposures in downdraft spray booths utilized in the furniture coating industry as published in the American Journal of Industrial Hygiene ____ (issue identifier) ____.

TAB 9 INDEX

- 1) Costs of a Respirator Program
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COSTS OF A RESPIRATOR PROGRAM

Direct Costs:

- Medical
- Respirators
- Maintenance
- Monitoring
- Fit Testing

Indirect Costs:

- Employee wages
- Program Administrator's wages
- OSHA fines
- Maintenance time
- Consulting physician fees
- Workers' compensation costs

COST JUSTIFICATION

A small manufacturing/engineering company had a painting operation with one employee assigned to perform the painting. The painting system was a two component acrylic enamel system that contained isocyanates and other ingredients identified as causing allergic skin reactions. The painting was performed in a spray paint booth. The parts painted were often large which required the painter to place himself between the part and the ventilation exhaust. The use of protective clothing and respiratory protection was sporadic. When used, the type of respirator worn was a half-face dual cartridge respirator with organic vapor cartridges. A respirator program was not in place.

The employee developed an allergic skin reaction and by his physician's order was not allowed to return to work until the condition cleared. When the condition cleared he returned to work and was assigned to a different position that had no contact with the paint. Within a few weeks the condition reappeared and upon further medical evaluation it was attributed to additives in the paint. The employee could not return to work, by the physician's orders.

The company had just been accepted into a group plan to receive a credit rating for their workers' compensation premiums. The total workers' compensation costs associated with this claim were \$166,791 and the claimant was eligible for 200 weeks of lost wages. Because of this one claim the employer lost their group status and associated credit rating and fell into a penalty rated status. Based on actual payroll reported, the difference between their credit rated premiums and penalty rated premiums was **\$40,933** per year.

Additional Costs

Hiring and Training New Employee: \$1000

Costs Associated with Supplied-air respirator, Respirator Program, and PPE

Up front equipment and program development cost:	\$2500
Annual equipment & maintenance cost:	\$2500
Annual Program cost (physicals, inspections, etc.):	\$1000
Total Cost first year:	\$6000
Total annual cost to maintain program:	\$3500

If the employer's claims experience and payroll remains the same over a five year period they will have paid an additional \$204,665 in workers' compensation premiums. Over the same five year period the cost associated with the use of the appropriate respirator, associated respirator program, and proper personal protective equipment (gloves, coveralls, etc.) would be \$20,000. An insignificant amount considering the cost associated with an occupational illness.

NEVER!!!!!

- Use an APR in an oxygen deficient atmosphere
- Use an APR in an IDLH environment
- Use an organic vapor cartridge in atmospheres with contaminant concentrations ≥ 1000 ppm
- Use a half-mask APR in an atmosphere above 10X the PEL
- Wear a tight fitting facepiece with facial hair
- Use APR for abrasive blasting, firefighting
- Use cartridges for chemicals other than those listed by the manufacturer
- Use airline couplings that are compatible with nonrespirable worksite air or other gas systems
- Use respirators which are not NIOSH approved
- Repair respirator's with anything other than the manufacturers replacement parts (only trained and authorized personnel can make repairs)
- Never use escape equipment for anything but escape



U.S. Department of Labor
Occupational Safety & Health Administration

www.osha.gov

Regulations (Standards - 29 CFR)
Respiratory Protection. - 1910.134

This section applies to General Industry (part 1910), Shipyards (part 1915), Marine Terminals (part 1917), Longshoring (part 1918), and Construction (part 1926).

1910.134(a) *Permissible practice.*

1910.134(a)(1) In the control of those occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective shall be to prevent atmospheric contamination. This shall be accomplished as far as feasible by accepted engineering control measures (for example, enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials). When effective engineering controls are not feasible, or while they are being instituted, appropriate respirators shall be used pursuant to this section.

1910.134(a)(2) Respirators shall be provided by the employer when such equipment is necessary to protect the health of the employee. The employer shall provide the respirators which are applicable and suitable for the purpose intended. The employer shall be responsible for the establishment and maintenance of a respiratory protection program which shall include the requirements outlined in paragraph (c) of this section.

1910.134(b) Definitions. The following definitions are important terms used in the respiratory protection standard in this section.

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) [Reserved]

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 facepiece only when a negative pressure is created inside the facepiece 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 facepiece (dust mask) means a negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium.

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.

Interior structural firefighting means the physical activity of fire suppression, rescue or both, inside of buildings or enclosed structures which are involved in a fire situation beyond the incipient stage. (See 29 CFR 1910.155)

Loose-fitting facepiece means a respiratory inlet covering that is designed to form a partial seal with the face.

Maximum use concentration (MUC) [Reserved].

Negative pressure respirator (tight fitting) means a respirator in which the air pressure inside the facepiece is negative during inhalation with respect to the ambient air pressure outside the respirator.

Oxygen deficient atmosphere 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 facepiece when the positive pressure is reduced inside the facepiece 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 facepiece, 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.

This section means this respiratory protection standard.

Tight-fitting facepiece 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.

1910.134(c) *Respiratory protection program.* This paragraph requires the employer to develop and implement a written respiratory protection program with required worksite-specific procedures and elements for required respirator use. The program must be administered by a suitably trained program administrator. In addition, certain program elements may be required for voluntary use to prevent potential hazards associated with the use of the respirator. The Small Entity Compliance Guide contains criteria for the selection of a program administrator and a sample program that meets the requirements of this paragraph. Copies of the Small Entity Compliance Guide will be available on or about April 8, 1998 from the Occupational Safety and Health Administration's Office of Publications, Room N 3101, 200 Constitution Avenue, NW, Washington, DC, 20210 (202-219-4667).

1910.134(c)(1) In any workplace where respirators are necessary to protect the health of the employee or whenever respirators are required by the employer, the employer shall establish and implement a written respiratory protection program with worksite-specific procedures. The program shall be updated as necessary to reflect those changes in workplace conditions that affect respirator use. The employer shall include in the program the following provisions of this section, as applicable:

1910.134(c)(1)(i) Procedures for selecting respirators for use in the workplace;

1910.134(c)(1)(ii) Medical evaluations of employees required to use respirators;

1910.134(c)(1)(iii) Fit testing procedures for tight-fitting respirators;

1910.134(c)(1)(iv) Procedures for proper use of respirators in routine and reasonably foreseeable emergency situations;

1910.134(c)(1)(v) Procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding, and otherwise maintaining respirators;

1910.134(c)(1)(vi) Procedures to ensure adequate air quality, quantity, and flow of breathing air for atmosphere-supplying respirators;

1910.134(c)(1)(vii) Training of employees in the respiratory hazards to which they are potentially exposed during routine and emergency situations;

1910.134(c)(1)(viii) Training of employees in the proper use of respirators, including putting on and removing them, any limitations on their use, and their maintenance; and

1910.134(c)(1)(ix) Procedures for regularly evaluating the effectiveness of the program.

1910.134(c)(2) Where respirator use is not required:

1910.134(c)(2)(i) An employer may provide respirators at the request of employees or permit employees to use their own respirators, if the employer determines that such respirator use will not in itself create a hazard. If the employer determines that any voluntary respirator use is permissible, the employer shall provide the respirator users with the information contained in Appendix D to this section ("Information for Employees Using Respirators When Not Required Under the Standard"); and

1910.134(c)(2)(ii) In addition, the employer must establish and implement those elements of a written respiratory protection program necessary to ensure that any employee using a respirator voluntarily is medically able to use that respirator, and that the respirator is cleaned, stored, and maintained so that its use does not present a health hazard to the user. **Exception:** Employers are not required to include in a written respiratory protection program those employees whose only use of respirators involves the voluntary use of filtering facepieces (dust masks).

1910.134(c)(3) The employer shall designate a program administrator who is qualified by appropriate training or experience that is commensurate with the complexity of the program to administer or oversee the respiratory protection program and conduct the required evaluations of program effectiveness.

1910.134(c)(4) The employer shall provide respirators, training, and medical evaluations at no cost to the employee.

1910.134(d) *Selection of respirators.* This paragraph requires the employer to evaluate respiratory hazard(s) in the workplace, identify relevant workplace and user factors, and base respirator selection on these factors. The paragraph also specifies appropriately protective respirators for use in IDLH atmospheres, and limits the selection and use of air-purifying respirators.

1910.134(d)(1) *General requirements.*

1910.134(d)(1)(i) The employer shall select and provide an appropriate respirator based on the respiratory hazard(s) to which the worker is exposed and workplace and user factors that affect respirator performance and reliability.

1910.134(d)(1)(ii) The employer shall select a NIOSH-certified respirator. The respirator shall be used in compliance with the conditions of its certification.

1910.134(d)(1)(iii) The employer shall identify and evaluate the respiratory hazard(s) in the workplace; this evaluation shall include a reasonable estimate of employee exposures to respiratory hazard(s) and an identification of the contaminant's chemical state and physical form. Where the employer cannot identify or reasonably estimate the employee exposure, the employer shall consider the atmosphere to be IDLH.

1910.134(d)(1)(iv) The employer shall select respirators from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user.

1910.134(d)(2) *Respirators for IDLH atmospheres.*

1910.134(d)(2)(i) The employer shall provide the following respirators for employee use in IDLH atmospheres:

1910.134(d)(2)(i)(A) A full facepiece pressure demand SCBA certified by NIOSH for a minimum service life of thirty minutes, or

1910.134(d)(2)(i)(B) A combination full facepiece pressure demand supplied-air respirator (SAR) with auxiliary self-contained air supply.

1910.134(d)(2)(ii) Respirators provided only for escape from IDLH atmospheres shall be NIOSH-certified for escape from the atmosphere in which they will be used.

1910.134(d)(2)(iii) All oxygen-deficient atmospheres shall be considered IDLH. Exception: If the employer demonstrates that, under all foreseeable conditions, the oxygen concentration can be maintained within the ranges specified in Table II of this section (i.e., for the altitudes set out in the table), then any atmosphere-supplying respirator may be used.

1910.134(d)(3) *Respirators for atmospheres that are not IDLH.*

1910.134(d)(3)(i) The employer shall provide a respirator that is adequate to protect the health of the employee and ensure compliance with all other OSHA statutory and regulatory requirements, under routine and reasonably foreseeable emergency situations.

1910.134(d)(3)(i)(A) *Assigned Protection Factors (APFs)* [Reserved]

1910.134(d)(3)(i)(B) *Maximum Use Concentration (MUC)* [Reserved]

1910.134(d)(3)(ii) The respirator selected shall be appropriate for the chemical state and physical form of the contaminant.

1910.134(d)(3)(iii) For protection against gases and vapors, the employer shall provide:

1910.134(d)(3)(iii)(A) An atmosphere-supplying respirator, or

1910.134(d)(3)(iii)(B) An air-purifying respirator, provided that:

1910.134(d)(3)(iii)(B)(1) The respirator is equipped with an end-of-service-life indicator (ESLI) certified by NIOSH for the contaminant; or

1910.134(d)(3)(iii)(B)(2) If there is no ESLI appropriate for conditions in the employer's workplace, the employer implements a change schedule for canisters and cartridges that is based on objective information or data that will ensure that canisters and cartridges are changed before the end of their service life. The employer shall describe in the respirator program the information and data relied

upon and the basis for the canister and cartridge change schedule and the basis for reliance on the data.

1910.134(d)(3)(iv) For protection against particulates, the employer shall provide:

1910.134(d)(3)(iv)(A) An atmosphere-supplying respirator; or

1910.134(d)(3)(iv)(B) An air-purifying respirator equipped with a filter certified by NIOSH under 30 CFR part 11 as a high efficiency particulate air (HEPA) filter, or an air-purifying respirator equipped with a filter certified for particulates by NIOSH under 42 CFR part 84; or

1910.134(d)(3)(iv)(C) For contaminants consisting primarily of particles with mass median aerodynamic diameters (MMAD) of at least 2 micrometers, an air-purifying respirator equipped with any filter certified for particulates by NIOSH.

TABLE I. –
ASSIGNED PROTECTION FACTORS
[RESERVED]

TABLE II

Altitude (ft.)	Oxygen deficient Atmospheres (% O ₂) for which the employer atmosphere may rely on supplying respirators
Less than 3,001	16.0-19.5
3,001-4,000	16.4-19.5
4,001-5,000	17.1-19.5
5,001-6,000	17.8-19.5
6,001-7,000	18.5-19.5
7,001-8,000 ¹	19.3-19.5.

¹Above 8,000 feet the exception does not apply. Oxygen-enriched breathing air must be supplied above 14,000 feet.

1910.134(e) *Medical evaluation.* Using a respirator may place a physiological burden on employees that varies with the type of respirator worn, the job and workplace conditions in which the respirator is used, and the medical status of the employee. Accordingly, this paragraph specifies the minimum requirements for medical evaluation that employers must implement to determine the employee's ability to use a respirator.

1910.134(e)(1) *General.* The employer shall provide a medical evaluation to determine the employee's ability to use a respirator, before the employee is fit tested or required to use the respirator in the workplace. The employer may discontinue an employee's medical evaluations when the employee is no longer required to use a respirator.

1910.134(e)(2) *Medical evaluation procedures.*

1910.134(e)(2)(i) The employer shall identify a physician or other licensed health care professional (PLHCP) to perform medical evaluations using a medical questionnaire or an initial medical examination that obtains the same information as the medical questionnaire.

1910.134(e)(2)(ii) The medical evaluation shall obtain the information requested by the questionnaire in Sections 1 and 2, Part A of Appendix C of this section.

1910.134(e)(3) *Follow-up medical examination.*

1910.134(e)(3)(i) The employer shall ensure that a follow-up medical examination is provided for an employee who gives a positive response to any question among questions 1 through 8 in Section 2, Part A of Appendix C or whose initial medical examination demonstrates the need for a follow-up medical examination.

1910.134(e)(3)(ii) The follow-up medical examination shall include any medical tests, consultations, or diagnostic procedures that the PLHCP deems necessary to make a final determination.

1910.134(e)(4) *Administration of the medical questionnaire and examinations.*

1910.134(e)(4)(i) The medical questionnaire and examinations shall be administered confidentially during the employee's normal working hours or at a

time and place convenient to the employee. The medical questionnaire shall be administered in a manner that ensures that the employee understands its content.

1910.134(e)(4)(ii) The employer shall provide the employee with an opportunity to discuss the questionnaire and examination results with the PLHCP.

1910.134(e)(5) *Supplemental information for the PLHCP.*

1910.134(e)(5)(i) The following information must be provided to the PLHCP before the PLHCP makes a recommendation concerning an employee's ability to use a respirator:

1910.134(e)(5)(i)(A) (A) The type and weight of the respirator to be used by the employee;

1910.134(e)(5)(i)(B) The duration and frequency of respirator use (including use for rescue and escape);

1910.134(e)(5)(i)(C) The expected physical work effort;

1910.134(e)(5)(i)(D) Additional protective clothing and equipment to be worn; and

1910.134(e)(5)(i)(E) Temperature and humidity extremes that may be encountered.

1910.134(e)(5)(ii) Any supplemental information provided previously to the PLHCP regarding an employee need not be provided for a subsequent medical evaluation if the information and the PLHCP remain the same.

1910.134(e)(5)(iii) The employer shall provide the PLHCP with a copy of the written respiratory protection program and a copy of this section.

Note to Paragraph (e)(5)(iii): When the employer replaces a PLHCP, the employer must ensure that the new PLHCP obtains this information, either by providing the documents directly to the PLHCP or having the documents transferred from the former PLHCP to the new PLHCP. However, OSHA does not expect employers to have employees medically reevaluated solely because a new PLHCP has been selected.

1910.134(e)(6) *Medical determination.* In determining the employee's ability to use a respirator, the employer shall:

1910.134(e)(6)(i) Obtain a written recommendation regarding the employee's ability to use the respirator from the PLHCP. The recommendation shall provide only the following information:

1910.134(e)(6)(i)(A) Any limitations on respirator use related to the medical condition of the employee, or relating to the workplace conditions in which the respirator will be used, including whether or not the employee is medically able to use the respirator;

1910.134(e)(6)(i)(B) The need, if any, for follow-up medical evaluations; and

1910.134(e)(6)(i)(C) A statement that the PLHCP has provided the employee with a copy of the PLHCP's written recommendation.

1910.134(e)(6)(ii) If the respirator is a negative pressure respirator and the PLHCP finds a medical condition that may place the employee's health at increased risk if the respirator is used, the employer shall provide a PAPR if the PLHCP's medical evaluation finds that the employee can use such a respirator; if a subsequent medical evaluation finds that the employee is medically able to use a negative pressure respirator, then the employer is no longer required to provide a PAPR.

1910.134(e)(7) *Additional medical evaluations.* At a minimum, the employer shall provide additional medical evaluations that comply with the requirements of this section if:

1910.134(e)(7)(i) An employee reports medical signs or symptoms that are related to ability to use a respirator;

1910.134(e)(7)(ii) A PLHCP, supervisor, or the respirator program administrator informs the employer that an employee needs to be reevaluated;

1910.134(e)(7)(iii) Information from the respiratory protection program, including observations made during fit testing and program evaluation, indicates a need for employee reevaluation; or

1910.134(e)(7)(iv) A change occurs in workplace conditions (e.g., physical work effort, protective clothing, temperature) that may result in a substantial increase in the physiological burden placed on an employee.

1910.134(f) *Fit testing.* This paragraph requires that, before an employee may be required to use any respirator with a negative or positive pressure tight-fitting facepiece, the employee must be fit tested with the same make, model, style, and size of respirator that will be used. This paragraph specifies the kinds of fit tests allowed, the procedures for conducting them, and how the results of the fit tests must be used.

1910.134(f)(1) The employer shall ensure that employees using a tight-fitting facepiece respirator pass an appropriate qualitative fit test (QLFT) or quantitative fit test (QNFT) as stated in this paragraph.

1910.134(f)(2) The employer shall ensure that an employee using a tight-fitting facepiece respirator is fit tested prior to initial use of the respirator, whenever a different respirator facepiece (size, style, model or make) is used, and at least annually thereafter.

1910.134(f)(3) The employer shall conduct an additional fit test whenever the employee reports, or the employer, PLHCP, supervisor, or program administrator makes visual observations of, changes in the employee's physical condition that could affect respirator fit. Such conditions include, but are not limited to, facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight.

1910.134(f)(4) If after passing a QLFT or QNFT, the employee subsequently notifies the employer, program administrator, supervisor, or PLHCP that the fit of the respirator is unacceptable, the employee shall be given a reasonable opportunity to select a different respirator facepiece and to be retested.

1910.134(f)(5) The fit test shall be administered using an OSHA-accepted QLFT or QNFT protocol. The OSHA-accepted QLFT and QNFT protocols and procedures are contained in Appendix A of this section.

1910.134(f)(6) QLFT may only be used to fit test negative pressure air-purifying respirators that must achieve a fit factor of 100 or less.

1910.134(f)(7) If the fit factor, as determined through an OSHA-accepted QNFT protocol, is equal to or greater than 100 for tight-fitting half facepieces, or equal to or greater than 500 for tight-fitting full facepieces, the QNFT has been passed with that respirator.

1910.134(f)(8) Fit testing of tight-fitting atmosphere-supplying respirators and tight-fitting powered air-purifying respirators shall be accomplished by performing quantitative or qualitative fit testing in the negative pressure mode, regardless of the mode of operation (negative or positive pressure) that is used for respiratory protection.

1910.134(f)(8)(i) Qualitative fit testing of these respirators shall be accomplished by temporarily converting the respirator user's actual facepiece into a negative pressure respirator with appropriate filters, or by using an identical negative pressure air-purifying respirator facepiece with the same sealing surfaces as a surrogate for the atmosphere-supplying or powered air-purifying respirator facepiece.

1910.134(f)(8)(ii) Quantitative fit testing of these respirators shall be accomplished by modifying the facepiece to allow sampling inside the facepiece in the breathing zone of the user, midway between the nose and mouth. This requirement shall be accomplished by installing a permanent sampling probe onto a surrogate facepiece, or by using a sampling adapter designed to temporarily provide a means of sampling air from inside the facepiece.

1910.134(f)(8)(iii) Any modifications to the respirator facepiece for fit testing shall be completely removed, and the facepiece restored to NIOSH-approved configuration, before that facepiece can be used in the workplace.

1910.134(g) *Use of respirators.* This paragraph requires employers to establish and implement procedures for the proper use of respirators. These requirements include prohibiting conditions that may result in facepiece seal leakage, preventing employees from removing respirators in hazardous environments, taking actions to ensure continued effective respirator operation throughout the work shift, and establishing procedures for the use of respirators in IDLH atmospheres or in interior structural firefighting situations.

1910.134(g)(1) *Facepiece seal protection.*

1910.134(g)(1)(i) The employer shall not permit respirators with tight-fitting facepieces to be worn by employees who have:

1910.134(g)(1)(i)(A) Facial hair that comes between the sealing surface of the facepiece and the face or that interferes with valve function; or

1910.134(g)(1)(i)(B) Any condition that interferes with the face-to-facepiece seal or valve function.

1910.134(g)(1)(ii) If an employee wears corrective glasses or goggles or other personal protective equipment, the employer shall ensure that such equipment is worn in a manner that does not interfere with the seal of the facepiece to the face of the user.

1910.134(g)(1)(iii) For all tight-fitting respirators, the employer shall ensure that employees perform a user seal check each time they put on the respirator using the procedures in Appendix B-1 or procedures recommended by the respirator manufacturer that the employer demonstrates are as effective as those in Appendix B-1 of this section.

1910.134(g)(2) *Continuing respirator effectiveness.*

1910.134(g)(2)(i) Appropriate surveillance shall be maintained of work area conditions and degree of employee exposure or stress. When there is a change in work area conditions or degree of employee exposure or stress that may affect respirator effectiveness, the employer shall reevaluate the continued effectiveness of the respirator.

1910.134(g)(2)(ii) The employer shall ensure that employees leave the respirator use area:

1910.134(g)(2)(ii)(A) To wash their faces and respirator facepieces as necessary to prevent eye or skin irritation associated with respirator use; or

1910.134(g)(2)(ii)(B) If they detect vapor or gas breakthrough, changes in breathing resistance, or leakage of the facepiece; or

1910.134(g)(2)(ii)(C) To replace the respirator or the filter, cartridge, or canister elements.

1910.134(g)(2)(iii) If the employee detects vapor or gas breakthrough, changes in breathing resistance, or leakage of the facepiece, the employer must replace or repair the respirator before allowing the employee to return to the work area.

1910.134(g)(3) *Procedures for IDLH atmospheres.* For all IDLH atmospheres, the employer shall ensure that:

1910.134(g)(3)(i) One employee or, when needed, more than one employee is located outside the IDLH atmosphere;

1910.134(g)(3)(ii) Visual, voice, or signal line communication is maintained between the employee(s) in the IDLH atmosphere and the employee(s) located outside the IDLH atmosphere;

1910.134(g)(3)(iii) The employee(s) located outside the IDLH atmosphere are trained and equipped to provide effective emergency rescue;

1910.134(g)(3)(iv) The employer or designee is notified before the employee(s) located outside the IDLH atmosphere enter the IDLH atmosphere to provide emergency rescue;

1910.134(g)(3)(v) The employer or designee authorized to do so by the employer, once notified, provides necessary assistance appropriate to the situation;

1910.134(g)(3)(vi) Employee(s) located outside the IDLH atmospheres are equipped with:

1910.134(g)(3)(vi)(A) Pressure demand or other positive pressure SCBAs, or a pressure demand or other positive pressure supplied-air respirator with auxiliary SCBA; and either

1910.134(g)(3)(vi)(B) Appropriate retrieval equipment for removing the employee(s) who enter(s) these hazardous atmospheres where retrieval equipment would contribute to the rescue of the employee(s) and would not increase the overall risk resulting from entry; or

1910.134(g)(3)(vi)(C) Equivalent means for rescue where retrieval equipment is not required under paragraph (g)(3)(vi)(B).

1910.134(g)(4) *Procedures for interior structural firefighting.* In addition to the requirements set forth under paragraph (g)(3), in interior structural fires, the employer shall ensure that:

1910.134(g)(4)(i) At least two employees enter the IDLH atmosphere and remain in visual or voice contact with one another at all times;

1910.134(g)(4)(ii) At least two employees are located outside the IDLH atmosphere; and

1910.134(g)(4)(iii) All employees engaged in interior structural firefighting use SCBAs.

Note 1 to paragraph (g): One of the two individuals located outside the IDLH atmosphere may be assigned to an additional role, such as incident commander in charge of the emergency or safety officer, so long as this individual is able to perform assistance or rescue activities without jeopardizing the safety or health of any firefighter working at the incident.

Note 2 to paragraph (g): Nothing in this section is meant to preclude firefighters from performing emergency rescue activities before an entire team has assembled.

1910.134(h) *Maintenance and care of respirators.* This paragraph requires the employer to provide for the cleaning and disinfecting, storage, inspection, and repair of respirators used by employees.

1910.134(h)(1) *Cleaning and disinfecting.* The employer shall provide each respirator user with a respirator that is clean, sanitary, and in good working order. The employer shall ensure that respirators are cleaned and disinfected using the procedures in Appendix B-2 of this section, or procedures recommended by the respirator manufacturer, provided that such procedures are of equivalent effectiveness. The respirators shall be cleaned and disinfected at the following intervals:

1910.134(h)(1)(i) Respirators issued for the exclusive use of an employee shall be cleaned and disinfected as often as necessary to be maintained in a sanitary condition;

1910.134(h)(1)(ii) Respirators issued to more than one employee shall be cleaned and disinfected before being worn by different individuals;

1910.134(h)(1)(iii) Respirators maintained for emergency use shall be cleaned and disinfected after each use; and

1910.134(h)(1)(iv) Respirators used in fit testing and training shall be cleaned and disinfected after each use.

1910.134(h)(2) *Storage.* The employer shall ensure that respirators are stored as follows:

1910.134(h)(2)(i) All respirators shall be stored to protect them from damage, contamination, dust, sunlight, extreme temperatures, excessive moisture, and damaging chemicals, and they shall be packed or stored to prevent deformation of the facepiece and exhalation valve.

1910.134(h)(2)(ii) In addition to the requirements of paragraph (h)(2)(i) of this section, emergency respirators shall be:

1910.134(h)(2)(ii)(A) Kept accessible to the work area;

1910.134(h)(2)(ii)(B) Stored in compartments or in covers that are clearly marked as containing emergency respirators; and

1910.134(h)(2)(ii)(C) Stored in accordance with any applicable manufacturer instructions.

1910.134(h)(3) *Inspection.*

1910.134(h)(3)(i) The employer shall ensure that respirators are inspected as follows:

1910.134(h)(3)(i)(A) All respirators used in routine situations shall be inspected before each use and during cleaning;

1910.134(h)(3)(i)(B) All respirators maintained for use in emergency situations shall be inspected at least monthly and in accordance with the manufacturer's recommendations, and shall be checked for proper function before and after each use; and

1910.134(h)(3)(i)(C) Emergency escape-only respirators shall be inspected before being carried into the workplace for use.

1910.134(h)(3)(ii) The employer shall ensure that respirator inspections include the following:

1910.134(h)(3)(ii)(A) A check of respirator function, tightness of connections, and the condition of the various parts including, but not limited to, the facepiece, head straps, valves, connecting tube, and cartridges, canisters or filters; and

1910.134(h)(3)(ii)(B) A check of elastomeric parts for pliability and signs of deterioration.

1910.134(h)(3)(iii) In addition to the requirements of paragraphs (h)(3)(i) and (ii) of this section, self-contained breathing apparatus shall be inspected monthly. Air and oxygen cylinders shall be maintained in a fully charged state and shall be recharged when the pressure falls to 90% of the manufacturer's recommended pressure level. The employer shall determine that the regulator and warning devices function properly.

1910.134(h)(3)(iv) For respirators maintained for emergency use, the employer shall:

1910.134(h)(3)(iv)(A) Certify the respirator by documenting the date the inspection was performed, the name (or signature) of the person who made the inspection, the findings, required remedial action, and a serial number or other means of identifying the inspected respirator; and

1910.134(h)(3)(iv)(B) Provide this information on a tag or label that is attached to the storage compartment for the respirator, is kept with the respirator, or is included in inspection reports stored as paper or electronic files. This information shall be maintained until replaced following a subsequent certification.

1910.134(h)(4) *Repairs.* The employer shall ensure that respirators that fail an inspection or are otherwise found to be defective are removed from service, and are discarded or repaired or adjusted in accordance with the following procedures:

1910.134(h)(4)(i) Repairs or adjustments to respirators are to be made only by persons appropriately trained to perform such operations and shall use only the respirator manufacturer's NIOSH-approved parts designed for the respirator;

1910.134(h)(4)(ii) Repairs shall be made according to the manufacturer's recommendations and specifications for the type and extent of repairs to be performed; and

1910.134(h)(4)(iii) Reducing and admission valves, regulators, and alarms shall be adjusted or repaired only by the manufacturer or a technician trained by the manufacturer.

1910.134(i) *Breathing air quality and use.* This paragraph requires the employer to provide employees using atmosphere-supplying respirators (supplied-air and SCBA) with breathing gases of high purity.

1910.134(i)(1) The employer shall ensure that compressed air, compressed oxygen, liquid air, and liquid oxygen used for respiration accords with the following specifications:

1910.134(i)(1)(i) Compressed and liquid oxygen shall meet the United States Pharmacopoeia requirements for medical or breathing oxygen; and

1910.134(i)(1)(ii) Compressed breathing air shall meet at least the requirements for Grade D breathing air described in ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-1989, to include:

1910.134(i)(1)(ii)(A) Oxygen content (v/v) of 19.5-23.5%;

1910.134(i)(1)(ii)(B) Hydrocarbon (condensed) content of 5 milligrams per cubic meter of air or less;

1910.134(i)(1)(ii)(C) Carbon monoxide (CO) content of 10 ppm or less;

1910.134(i)(1)(ii)(D) Carbon dioxide content of 1,000 ppm or less; and

1910.134(i)(1)(ii)(E) Lack of noticeable odor.

1910.134(i)(2) The employer shall ensure that compressed oxygen is not used in atmosphere-supplying respirators that have previously used compressed air.

1910.134(i)(3) The employer shall ensure that oxygen concentrations greater than 23.5% are used only in equipment designed for oxygen service or distribution.

1910.134(i)(4) The employer shall ensure that cylinders used to supply breathing air to respirators meet the following requirements:

1910.134(i)(4)(i) Cylinders are tested and maintained as prescribed in the Shipping Container Specification Regulations of the Department of Transportation (49 CFR part 173 and part 178);

1910.134(i)(4)(ii) Cylinders of purchased breathing air have a certificate of analysis from the supplier that the breathing air meets the requirements for Grade D breathing air; and

1910.134(i)(4)(iii) The moisture content in the cylinder does not exceed a dew point of -50 deg.F (-45.6 deg.C) at 1 atmosphere pressure.

1910.134(i)(5) The employer shall ensure that compressors used to supply breathing air to respirators are constructed and situated so as to:

1910.134(i)(5)(i) Prevent entry of contaminated air into the air-supply system;

1910.134(i)(5)(ii) Minimize moisture content so that the dew point at 1 atmosphere pressure is 10 degrees F (5.56 deg.C) below the ambient temperature;

1910.134(i)(5)(iii) Have suitable in-line air-purifying sorbent beds and filters to further ensure breathing air quality. Sorbent beds and filters shall be maintained and replaced or refurbished periodically following the manufacturer's instructions.

1910.134(i)(5)(iv) Have a tag containing the most recent change date and the signature of the person authorized by the employer to perform the change. The tag shall be maintained at the compressor.

1910.134(i)(6) For compressors that are not oil-lubricated, the employer shall ensure that carbon monoxide levels in the breathing air do not exceed 10 ppm.

1910.134(i)(7) For oil-lubricated compressors, the employer shall use a high-temperature or carbon monoxide alarm, or both, to monitor carbon monoxide levels. If only high-temperature alarms are used, the air supply shall be monitored at intervals sufficient to prevent carbon monoxide in the breathing air from exceeding 10 ppm.

1910.134(i)(8) The employer shall ensure that breathing air couplings are incompatible with outlets for nonrespirable worksite air or other gas systems. No asphyxiating substance shall be introduced into breathing air lines.

1910.134(i)(9) The employer shall use breathing gas containers marked in accordance with the NIOSH respirator certification standard, 42 CFR part 84.

1910.134(j) *Identification of filters, cartridges, and canisters.*

The employer shall ensure that all filters, cartridges and canisters used in the workplace are labeled and color coded with the NIOSH approval label and that the label is not removed and remains legible.

1910.134(k) *Training and information.* This paragraph requires the employer to provide effective training to employees who are required to use respirators. The training must be comprehensive, understandable, and recur annually, and more often if necessary. This paragraph also requires the employer to provide the basic information on respirators in Appendix D of this section to employees who wear respirators when not required by this section or by the employer to do so.

1910.134(k)(1) The employer shall ensure that each employee can demonstrate knowledge of at least the following:

1910.134(k)(1)(i) Why the respirator is necessary and how improper fit, usage, or maintenance can compromise the protective effect of the respirator;

1910.134(k)(1)(ii) What the limitations and capabilities of the respirator are;

1910.134(k)(1)(iii) How to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions;

1910.134(k)(1)(iv) How to inspect, put on and remove, use, and check the seals of the respirator;

1910.134(k)(1)(v) What the procedures are for maintenance and storage of the respirator;

1910.134(k)(1)(vi) How to recognize medical signs and symptoms that may limit or prevent the effective use of respirators; and

1910.134(k)(1)(vii) The general requirements of this section.

1910.134(k)(2) The training shall be conducted in a manner that is understandable to the employee.

1910.134(k)(3) The employer shall provide the training prior to requiring the employee to use a respirator in the workplace.

1910.134(k)(4) An employer who is able to demonstrate that a new employee has received training within the last 12 months that addresses the elements specified in paragraph (k)(1)(i) through (vii) is not required to repeat such training provided that, as required by paragraph (k)(1), the employee can demonstrate knowledge of those element(s). Previous training not repeated initially by the employer must be provided no later than 12 months from the date of the previous training.

1910.134(k)(5) Retraining shall be administered annually, and when the following situations occur:

1910.134(k)(5)(i) Changes in the workplace or the type of respirator render previous training obsolete;

1910.134(k)(5)(ii) Inadequacies in the employee's knowledge or use of the respirator indicate that the employee has not retained the requisite understanding or skill; or

1910.134(k)(5)(iii) Any other situation arises in which retraining appears necessary to ensure safe respirator use.

1910.134(k)(6) The basic advisory information on respirators, as presented in Appendix D of this section, shall be provided by the employer in any written or oral format, to employees who wear respirators when such use is not required by this section or by the employer.

1910.134(l) *Program evaluation.* This section requires the employer to conduct evaluations of the workplace to ensure that the written respiratory protection program is being properly implemented, and to consult employees to ensure that they are using the respirators properly.

1910.134(l)(1) The employer shall conduct evaluations of the workplace as necessary to ensure that the provisions of the current written program are being effectively implemented and that it continues to be effective.

1910.134(l)(2) The employer shall regularly consult employees required to use respirators to assess the employees' views on program effectiveness and to identify any problems. Any problems that are identified during this assessment shall be corrected. Factors to be assessed include, but are not limited to:

1910.134(l)(2)(i) Respirator fit (including the ability to use the respirator without interfering with effective workplace performance);

1910.134(l)(2)(ii) Appropriate respirator selection for the hazards to which the employee is exposed;

1910.134(l)(2)(iii) Proper respirator use under the workplace conditions the employee encounters; and

1910.134(l)(2)(iv) Proper respirator maintenance.

1910.134(m) *Recordkeeping.* This section requires the employer to establish and retain written information regarding medical evaluations, fit testing, and the respirator program. This information will facilitate employee involvement in the respirator program, assist the employer in auditing the adequacy of the program, and provide a record for compliance determinations by OSHA.

1910.134(m)(1) *Medical evaluation.* Records of medical evaluations required by this section must be retained and made available in accordance with 29 CFR 1910.1020.

1910.134(m)(2) *Fit testing.*

1910.134(m)(2)(i) The employer shall establish a record of the qualitative and quantitative fit tests administered to an employee including:

1910.134(m)(2)(i)(A) The name or identification of the employee tested;

1910.134(m)(2)(i)(B) Type of fit test performed;

1910.134(m)(2)(i)(C) Specific make, model, style, and size of respirator tested;

1910.134(m)(2)(i)(D) Date of test; and

1910.134(m)(2)(i)(E) The pass/fail results for QLFTs or the fit factor and strip chart recording or other recording of the test results for QNFTs.

1910.134(m)(2)(ii) Fit test records shall be retained for respirator users until the next fit test is administered.

1910.134(m)(3) A written copy of the current respirator program shall be retained by the employer.

1910.134(m)(4) Written materials required to be retained under this paragraph shall be made available upon request to affected employees and to the Assistant Secretary or designee for examination and copying.

1910.134(n) *Dates.*

1910.134(n)(1) *Effective date.* This section is effective April 8, 1998. The obligations imposed by this section commence on the effective date unless otherwise noted in this paragraph. Compliance with obligations that do not commence on the effective date shall occur no later than the applicable start-up date.

1910.134(n)(2) *Compliance dates.* All obligations of this section commence on the effective date except as follows:

1910.134(n)(2)(i) The determination that respirator use is required (paragraph (a)) shall be completed no later than September 8, 1998.

1910.134(n)(2)(ii) Compliance with provisions of this section for all other provisions shall be completed no later than October 5, 1998.

1910.134(n)(3) The provisions of 29 CFR 1910.134 and 29 CFR 1926.103, contained in the 29 CFR parts 1900 to 1910.99 and the 29 CFR part 1926 editions, revised as of July 1, 1997, are in effect and enforceable until October 5, 1998, or during any administrative or judicial stay of the provisions of this section.

1910.134(n)(4) *Existing Respiratory Protection Programs.* If, in the 12 month period preceding April 8, 1998, the employer has conducted annual respirator training, fit testing, respirator program evaluation, or medical evaluations, the employer may use the results of those activities to comply with the corresponding provisions of this section, providing that these activities were conducted in a manner that meets the requirements of this section.

1910.134(o) *Appendices.*

1910.134(o)(1) Compliance with Appendix A, Appendix B-1, Appendix B-2, and Appendix C of this section is mandatory.

1910.134(o)(2) Appendix D of this section is non-mandatory and is not intended to create any additional obligations not otherwise imposed or to detract from any existing obligations.

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

Fit Testing Procedures (Mandatory). - 1910.134 App A

Appendix A to § 1910.134: Fit Testing Procedures (Mandatory)

Part I. OSHA-Accepted Fit Test Protocols

A. Fit Testing Procedures -- General Requirements The employer shall conduct fit testing using the following procedures. The requirements in this appendix apply to all OSHA-accepted fit test methods, both QLFT and QNFT.

1. The test subject shall be allowed to pick the most acceptable respirator from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user.
2. Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine an acceptable fit. A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This instruction may not constitute the subject's formal training on respirator use, because it is only a review.
3. The test subject shall be informed that he/she is being asked to select the respirator that provides the most acceptable fit. Each respirator represents a different size and shape, and if fitted and used properly, will provide adequate protection.
4. The test subject shall be instructed to hold each chosen facepiece up to the face and eliminate those that obviously do not give an acceptable fit.
5. The more acceptable facepieces are noted in case the one selected proves unacceptable; the most comfortable mask is donned and worn at least five minutes to assess comfort. Assistance in assessing comfort can be given by discussing the points in the following item A.6. If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.
6. Assessment of comfort shall include a review of the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator:
 - (a) Position of the mask on the nose
 - (b) Room for eye protection
 - (c) Room to talk

(d) Position of mask on face and cheek

7. The following criteria shall be used to help determine the adequacy of the respirator fit:

(a) Chin properly placed;

(b) Adequate strap tension, not overly tightened;

(c) Fit across nose bridge;

(d) Respirator of proper size to span distance from nose to chin;

(e) Tendency of respirator to slip;

(f) Self-observation in mirror to evaluate fit and respirator position.

8. The test subject shall conduct a user seal check, either the negative and positive pressure seal checks described in Appendix B-1 of this section or those recommended by the respirator manufacturer which provide equivalent protection to the procedures in Appendix B-1. Before conducting the negative and positive pressure checks, the subject shall be told to seat the mask on the face by moving the head from side-to-side and up and down slowly while taking in a few slow deep breaths. Another facepiece shall be selected and retested if the test subject fails the user seal check tests.

9. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface, such as stubble beard growth, beard, mustache or sideburns which cross the respirator sealing surface. Any type of apparel which interferes with a satisfactory fit shall be altered or removed.

10. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician or other licensed health care professional, as appropriate, to determine whether the test subject can wear a respirator while performing her or his duties.

11. If the employee finds the fit of the respirator unacceptable, the test subject shall be given the opportunity to select a different respirator and to be retested.

12. Exercise regimen. Prior to the commencement of the fit test, the test subject shall be given a description of the fit test and the test subject's responsibilities during the test procedure. The description of the process shall include a description of the test exercises that the subject will be performing. The respirator to be tested shall be worn for at least 5 minutes before the start of the fit test.

13. The fit test shall be performed while the test subject is wearing any applicable safety equipment that may be worn during actual respirator use which could interfere with respirator fit.

14. Test Exercises. (a) The following test exercises are to be performed for all fit testing methods prescribed in this appendix, except for the CNP method. A separate fit testing exercise regimen is contained in the CNP protocol. The test subject shall perform exercises, in the test environment, in the following manner:

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

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

(3) 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.

(4) 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).

(5) 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.

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

(7) 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.

(8) Normal breathing. Same as exercise (1).

(b) 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.

B. Qualitative Fit Test (QLFT) Protocols

1. General

(a) The employer shall ensure that persons administering QLFT are able to prepare test solutions, calibrate equipment and perform tests properly, recognize invalid tests, and ensure that test equipment is in proper working order.

(b) The employer shall ensure that QLFT equipment is kept clean and well maintained so as to operate within the parameters for which it was designed.

2. Isoamyl Acetate Protocol

Note: This protocol is not appropriate to use for the fit testing of particulate respirators. If used to fit test particulate respirators, the respirator must be equipped with an organic vapor filter.

(a) Odor Threshold Screening

Odor threshold screening, performed without wearing a respirator, is intended to determine if the individual tested can detect the odor of isoamyl acetate at low levels.

(1) Three 1 liter glass jars with metal lids are required.

(2) Odor-free water (e.g., distilled or spring water) at approximately 25 deg. C (77 deg. F) shall be used for the solutions.

(3) The isoamyl acetate (IAA) (also known as isopentyl acetate) stock solution is prepared by adding 1 ml of pure IAA to 800 ml of odor-free water in a 1 liter jar, closing the lid and shaking for 30 seconds. A new solution shall be prepared at least weekly.

(4) The screening test shall be conducted in a room separate from the room used for actual fit testing. The two rooms shall be well-ventilated to prevent the odor of IAA from becoming evident in the general room air where testing takes place.

(5) The odor test solution is prepared in a second jar by placing 0.4 ml of the stock solution into 500 ml of odor-free water using a clean dropper or pipette. The solution shall be shaken for 30 seconds and allowed to stand for two to three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution shall be used for only one day.

(6) A test blank shall be prepared in a third jar by adding 500 cc of odor-free water.

(7) The odor test and test blank jar lids shall be labeled (e.g., 1 and 2) for jar identification. Labels shall be placed on the lids so that they can be peeled off periodically and switched to maintain the integrity of the test.

(8) The following instruction shall be typed on a card and placed on the table in front of the two test jars (i.e., 1 and 2): "The purpose of this test is to determine if you can smell banana oil at a low concentration. The two bottles in front of you contain water. One of these bottles also contains a small amount of banana oil. Be sure the covers are on tight, then shake each bottle for two seconds. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle. Indicate to the test conductor which bottle contains banana oil."

(9) The mixtures used in the IAA odor detection test shall be prepared in an area separate from where the test is performed, in order to prevent olfactory fatigue in the subject.

(10) If the test subject is unable to correctly identify the jar containing the odor test solution, the IAA qualitative fit test shall not be performed.

(11) If the test subject correctly identifies the jar containing the odor test solution, the test subject may proceed to respirator selection and fit testing.

(b) Isoamyl Acetate Fit Test

(1) The fit test chamber shall be a clear 55-gallon drum liner suspended inverted over a 2-foot diameter frame so that the top of the chamber is about 6 inches above the test subject's head. If no drum liner is available, a similar chamber shall be constructed using plastic sheeting. The inside top center of the chamber shall have a small hook attached.

(2) Each respirator used for the fitting and fit testing shall be equipped with organic vapor cartridges or offer protection against organic vapors.

(3) After selecting, donning, and properly adjusting a respirator, the test subject shall wear it to the fit testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well-ventilated, as by an exhaust fan or lab hood, to prevent general room contamination.

(4) A copy of the test exercises and any prepared text from which the subject is to read shall be taped to the inside of the test chamber.

(5) Upon entering the test chamber, the test subject shall be given a 6-inch by 5-inch piece of paper towel, or other porous, absorbent, single-ply material, folded in half and wetted with 0.75 ml of pure IAA. The test subject shall hang the wet towel on the hook at the top of the chamber. An IAA test swab or ampule may be substituted for the IAA wetted paper towel provided it has been demonstrated that the alternative IAA source will generate an IAA test atmosphere with a concentration equivalent to that generated by the paper towel method.

(6) Allow two minutes for the IAA test concentration to stabilize before starting the fit test exercises. This would be an appropriate time to talk with the test subject; to explain the fit test, the importance of his/her cooperation, and the purpose for the test exercises; or to demonstrate some of the exercises.

(7) If at any time during the test, the subject detects the banana-like odor of IAA, the test is failed. The subject shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.

(8) If the test is failed, the subject shall return to the selection room and remove the respirator. The test subject shall repeat the odor sensitivity test, select and put on another respirator, return to the test area and again begin the fit test procedure described in (b) (1) through (7) above. The process continues until a respirator that fits well has been found. Should the odor sensitivity test be failed, the subject shall wait at least 5 minutes before retesting. Odor sensitivity will usually have returned by this time.

(9) If the subject passes the test, the efficiency of the test procedure shall be demonstrated by having the subject break the respirator face seal and take a breath before exiting the chamber.

(10) When the test subject leaves the chamber, the subject shall remove the saturated towel and return it to the person conducting the test, so that there is no significant IAA concentration buildup in the chamber during subsequent tests. The used towels shall be kept in a self-sealing plastic bag to keep the test area from being contaminated.

3. 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 (see (b)(5) below) 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 in section I. A. of this appendix. 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 section I. A. 14. of this appendix.

(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.

4. Bitrex™ (Denatonium Benzoate) Solution Aerosol Qualitative Fit Test 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 10), 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 4. (a) above.

(3) The test subject shall don the enclosure while wearing the respirator selected according to section I. A. of this appendix. 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 section I. A. 14. of this appendix.

(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).

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.

(a) General Requirements and Precautions

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

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

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

(4) 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.

(5) 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.

(b) Sensitivity Screening Check

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

(1) 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.

(2) 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.

(3) 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.

(c) Irritant Smoke Fit Test Procedure

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

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

(3) 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.

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

(5) The exercises identified in section I.A. 14. of this appendix 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.

(6) 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.

(7) 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.

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

C. Quantitative Fit Test (QNFT) Protocols

The following quantitative fit testing procedures have been demonstrated to be acceptable: Quantitative fit testing using a non-hazardous test aerosol (such as corn oil, polyethylene glycol 400 [PEG 400], di-2-ethyl hexyl sebacate [DEHS], or sodium chloride) generated in a test chamber, and employing instrumentation to quantify the fit of the respirator; Quantitative fit testing using ambient aerosol as the test agent and appropriate instrumentation (condensation nuclei counter) to quantify the respirator fit; Quantitative fit testing using controlled negative pressure and appropriate instrumentation to measure the volumetric leak rate of a facepiece to quantify the respirator fit.

1. General

(a) The employer shall ensure that persons administering QNFT are able to calibrate equipment and perform tests properly, recognize invalid tests, calculate fit factors properly and ensure that test equipment is in proper working order.

(b) The employer shall ensure that QNFT equipment is kept clean, and is maintained and calibrated according to the manufacturer's instructions so as to operate at the parameters for which it was designed.

2. Generated Aerosol Quantitative Fit Testing Protocol

(a) Apparatus.

(1) Instrumentation. Aerosol generation, dilution, and measurement systems using particulates (corn oil, polyethylene glycol 400 [PEG 400], di-2-ethyl hexyl sebacate [DEHS] or sodium chloride) as test aerosols shall be used for quantitative fit testing.

(2) Test chamber. The test chamber shall be large enough to permit all test subjects to perform freely all required exercises without disturbing the test agent concentration or the measurement apparatus. The test chamber shall be equipped and constructed so that the test agent is effectively isolated from the ambient air, yet uniform in concentration throughout the chamber.

(3) When testing air-purifying respirators, the normal filter or cartridge element shall be replaced with a high efficiency particulate air (HEPA) or P100 series filter supplied by the same manufacturer.

(4) The sampling instrument shall be selected so that a computer record or strip chart record may be made of the test showing the rise and fall of the test agent concentration with each inspiration and expiration at fit factors of at least 2,000. Integrators or computers that integrate the amount of test agent penetration leakage into the respirator for each exercise may be used provided a record of the readings is made.

(5) The combination of substitute air-purifying elements, test agent and test agent concentration shall be such that the test subject is not exposed in excess of an established exposure limit for the test agent at any time during the testing process, based upon the length of the exposure and the exposure limit duration.

(6) The sampling port on the test specimen respirator shall be placed and constructed so that no leakage occurs around the port (e.g., where the respirator is probed), a free air flow is allowed into the sampling line at all times, and there is no interference with the fit or performance of the respirator. The in-mask sampling device (probe) shall be designed and used so that the air sample is drawn from the breathing zone of the test subject, midway between the nose and mouth and with the probe extending into the facepiece cavity at least 1/4 inch.

(7) The test setup shall permit the person administering the test to observe the test subject inside the chamber during the test.

(8) The equipment generating the test atmosphere shall maintain the concentration of test agent constant to within a 10 percent variation for the duration of the test.

(9) The time lag (interval between an event and the recording of the event on the strip chart or computer or integrator) shall be kept to a minimum. There shall be a clear association between the occurrence of an event and its being recorded.

(10) The sampling line tubing for the test chamber atmosphere and for the respirator sampling port shall be of equal diameter and of the same material. The length of the two lines shall be equal.

(11) The exhaust flow from the test chamber shall pass through an appropriate filter (i.e., high efficiency particulate filter) before release.

(12) When sodium chloride aerosol is used, the relative humidity inside the test chamber shall not exceed 50 percent.

(13) The limitations of instrument detection shall be taken into account when determining the fit factor.

(14) Test respirators shall be maintained in proper working order and be inspected regularly for deficiencies such as cracks or missing valves and gaskets.

(b) Procedural Requirements.

(1) When performing the initial user seal check using a positive or negative pressure check, the sampling line shall be crimped closed in order to avoid air pressure leakage during either of these pressure checks.

(2) The use of an abbreviated screening QLFT test is optional. Such a test may be utilized in order to quickly identify poor fitting respirators that passed the positive and/or negative pressure test and reduce the amount of QNFT time. The use of the CNC QNFT instrument in the count mode is another optional method to obtain a quick estimate of fit and eliminate poor fitting respirators before going on to perform a full QNFT.

(3) A reasonably stable test agent concentration shall be measured in the test chamber prior to testing. For canopy or shower curtain types of test units, the determination of the test agent's stability may be established after the test subject has entered the test environment.

(4) Immediately after the subject enters the test chamber, the test agent concentration inside the respirator shall be measured to ensure that the peak penetration does not exceed 5 percent for a half mask or 1 percent for a full facepiece respirator.

(5) A stable test agent concentration shall be obtained prior to the actual start of testing.

(6) Respirator restraining straps shall not be over-tightened for testing. The straps shall be adjusted by the wearer without assistance from other persons to give a reasonably comfortable fit typical of normal use. The respirator shall not be adjusted once the fit test exercises begin.

(7) The test shall be terminated whenever any single peak penetration exceeds 5 percent for half masks and 1 percent for full facepiece respirators. The test subject shall be refitted and retested.

(8) Calculation of fit factors.

(i) The fit factor shall be determined for the quantitative fit test by taking the ratio of the average chamber concentration to the concentration measured inside the respirator for each test exercise except the grimace exercise.

(ii) The average test chamber concentration shall be calculated as the arithmetic average of the concentration measured before and after each test (i.e., 7 exercises) or the arithmetic average of the concentration measured before and after each exercise or the true average measured continuously during the respirator sample.

(iii) The concentration of the challenge agent inside the respirator shall be determined by one of the following methods:

(A) Average peak penetration method means the method of determining test agent penetration into the respirator utilizing a strip chart recorder, integrator, or computer. The agent penetration is determined by an average of the peak heights on the graph or by computer integration, for each exercise except the grimace exercise. Integrators or computers that calculate the actual test agent penetration into the respirator for each exercise will also be considered to meet the requirements of the average peak penetration method.

(B) Maximum peak penetration method means the method of determining test agent penetration in the respirator as determined by strip chart recordings of the test. The highest peak penetration for a given exercise is taken to be representative of average penetration into the respirator for that exercise.

(C) Integration by calculation of the area under the individual peak for each exercise except the grimace exercise. This includes computerized integration.

(D) The calculation of the overall fit factor using individual exercise fit factors involves first converting the exercise fit factors to penetration values, determining the average, and then converting that result back to a fit factor. This procedure is described in the following equation:

$$\text{Overall Fit Factor} = \frac{\text{Number of exercises}}{1/ff_1 + 1/ff_2 + 1/ff_3 + 1/ff_4 + 1/ff_5 + 1/ff_6 + 1/ff_7 + 1/ff_8}$$

Where ff_1 , ff_2 , ff_3 , etc. are the fit factors for exercises 1, 2, 3, etc.

(9) The test subject shall not be permitted to wear a half mask or quarter facepiece respirator unless a minimum fit factor of 100 is obtained, or a full facepiece respirator unless a minimum fit factor of 500 is obtained.

(10) Filters used for quantitative fit testing shall be replaced whenever increased breathing resistance is encountered, or when the test agent has altered the integrity of the filter media.

3. Ambient aerosol condensation nuclei counter (CNC) quantitative fit testing protocol.

The ambient aerosol condensation nuclei counter (CNC) quantitative fit testing (Portacount™) protocol quantitatively fit tests respirators with the use of a probe. The probed respirator is only used for quantitative fit tests. A probed respirator has a special sampling device, installed on the respirator, that allows the probe to sample the air from inside the mask. A probed respirator is required for each make, style, model, and size that the employer uses and can be obtained from the respirator manufacturer or distributor. The CNC instrument manufacturer, TSI Inc., also provides probe attachments (TSI sampling adapters) that permit fit testing in an employee's own respirator. A minimum fit factor pass level of at least 100 is necessary for a half-mask respirator and a minimum fit factor pass level of at least 500 is required for a full facepiece negative pressure respirator. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) Portacount Fit Test Requirements.

(1) 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.

(2) 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.

(3) 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.

(4) 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.

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

(6) The test subject shall be instructed to perform the exercises in section I. A. 14. of this appendix.

(7) 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.

(b) Portacount Test Instrument.

(1) 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.

(2) 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.

(3) 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.

4. Controlled negative pressure (CNP) quantitative fit testing protocol.

The CNP protocol provides an alternative to aerosol fit test methods. The CNP fit test method technology is based on exhausting air from a temporarily sealed respirator facepiece to generate and then maintain a constant negative pressure inside the facepiece. The rate of air exhaust is controlled so that a constant negative pressure is maintained in the respirator during the fit test. The level of pressure is selected to replicate the mean inspiratory pressure that causes leakage into the respirator under normal use conditions. With pressure held constant, air flow out of the respirator is equal to air flow into the respirator. Therefore, measurement of the exhaust stream that is required to hold the pressure in the temporarily sealed respirator constant yields a direct measure of leakage air flow into the respirator. The CNP fit test method measures leak rates through the facepiece as a method for determining the facepiece fit for negative pressure respirators. The CNP instrument manufacturer Dynatech Nevada also provides attachments (sampling manifolds) that replace the filter cartridges to permit fit testing in an employee's own respirator. To perform the test, the test subject closes his or her mouth and holds his/her breath, after which an air pump removes air from the respirator facepiece at a pre-selected constant pressure. The facepiece fit is expressed as the leak rate through the facepiece, expressed as milliliters per minute. The quality and validity of the CNP fit tests are determined by the degree to which the in-mask pressure tracks the test pressure during the system measurement time of approximately five seconds. Instantaneous feedback in the form of a real-time pressure trace of the in-mask pressure is provided and used to determine test validity and quality. A minimum fit factor pass level of 100 is necessary for a half-mask respirator and a minimum fit factor of at least 500 is required for a full facepiece respirator. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) CNP Fit Test Requirements.

(1) The instrument shall have a non-adjustable test pressure of 15.0 mm water pressure.

(2) The CNP system defaults selected for test pressure shall be set at -- 15 mm of water (-0.58 inches of water) and the modeled inspiratory flow rate shall be 53.8 liters per minute for performing fit tests.

(Note: CNP systems have built-in capability to conduct fit testing that is specific to unique work rate, mask, and gender situations that might apply in a specific workplace. Use of system default values, which were selected to represent respirator wear with medium cartridge resistance at a low-moderate work rate, will allow inter-test comparison of the respirator fit.)

(3) The individual who conducts the CNP fit testing shall be thoroughly trained to perform the test.

(4) The respirator filter or cartridge needs to be replaced with the CNP test manifold. The inhalation valve downstream from the manifold either needs to be temporarily removed or propped open.

(5) The test subject shall be trained to hold his or her breath for at least 20 seconds.

(6) The test subject shall don the test respirator without any assistance from the individual who conducts the CNP fit test.

(7) The QNFT protocol shall be followed according to section I.

C. 1. of this appendix with an exception for the CNP test exercises.

(b) CNP Test Exercises.

(1) Normal breathing. In a normal standing position, without talking, the subject shall breathe normally for 1 minute. After the normal breathing exercise, the subject needs to hold head straight ahead and hold his or her breath for 10 seconds during the test measurement.

(2) Deep breathing. In a normal standing position, the subject shall breathe slowly and deeply for 1 minute, being careful not to hyperventilate. After the deep breathing exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during test measurement.

(3) Turning head side to side. Standing in place, the subject shall slowly turn his or her head from side to side between the extreme positions on each side for 1 minute. The head shall be held at each extreme momentarily so the subject can inhale at each side. After the turning head side to side exercise, the subject needs to hold head full left and hold his or her breath for 10 seconds during test measurement. Next, the subject needs to hold head full right and hold his or her breath for 10 seconds during test measurement.

(4) Moving head up and down. Standing in place, the subject shall slowly move his or her head up and down for 1 minute. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling). After the moving head up and down exercise, the subject shall hold his or her head full up and hold his or her breath for 10 seconds during test measurement. Next, the subject shall hold his or her head full down and hold his or her breath for 10 seconds during test measurement.

(5) 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 for 1 minute. After the talking exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during the test measurement.

(6) Grimace. The test subject shall grimace by smiling or frowning for 15 seconds.

(7) Bending Over. The test subject shall bend at the waist as if he or she were to touch his or her toes for 1 minute. Jogging in place shall be substituted for this exercise in those test environments such as shroud-type QNFT units that prohibit bending at the waist. After the bending over exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during the test measurement.

(8) Normal Breathing. The test subject shall remove and re-don the respirator within a one-minute period. Then, in a normal standing position, without talking, the subject shall breathe normally for 1 minute. After the normal breathing exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during the test measurement. 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 a respirator shall be tried.

(c) CNP Test Instrument.

(1) The test instrument shall have an effective audio warning device when the test subject fails to hold his or her breath during the test. The test shall be terminated whenever the test subject failed to hold his or her breath. The test subject may be refitted and retested.

(2) A record of the test shall 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.

Part II. New Fit Test Protocols

A. Any person may submit to OSHA an application for approval of a new fit test protocol. If the application meets the following criteria, OSHA will initiate a rulemaking proceeding under section 6(b)(7) of the OSH Act to determine whether to list the new protocol as an approved protocol in this Appendix A.

B. The application must include a detailed description of the proposed new fit test protocol. This application must be supported by either:

1. A test report prepared by an independent government research laboratory (e.g., Lawrence Livermore National Laboratory, Los Alamos National Laboratory, the National Institute for Standards and Technology) stating that the laboratory has tested the protocol and had found it to be accurate and reliable; or

2. An article that has been published in a peer-reviewed industrial hygiene journal describing the protocol and explaining how test data support the protocol's accuracy and reliability.

C. If OSHA determines that additional information is required before the Agency commences a rulemaking proceeding under this section, OSHA will so notify the applicant and afford the applicant the opportunity to submit the supplemental information. Initiation of a rulemaking proceeding will be deferred until OSHA has received and evaluated the supplemental information.

[63 FR 20098, April 23, 1998]

Appendix B-1 to § 1910.134: User Seal Check Procedures

(Mandatory)

The individual who uses a tight-fitting respirator is to perform a user seal check to ensure that an adequate seal is achieved each time the respirator is put on. Either the positive and negative pressure checks listed in this appendix, or the respirator manufacturer's recommended user seal check method shall be used. User seal checks are not substitutes for qualitative or quantitative fit tests.

I. Facepiece Positive and/or Negative Pressure Checks

A. Positive pressure 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 up inside the facepiece without any evidence of outward leakage of air at the seal. For most respirators this method of leak testing requires the wearer to first remove the exhalation valve cover before closing off the exhalation valve and then carefully replacing it after the test.

B. Negative pressure check. Close off the inlet opening of the canister or cartridge(s) by covering with the palm of the hand(s) or by replacing the filter seal(s), inhale gently so that the facepiece collapses slightly, and hold the breath for ten seconds. The design of the inlet opening of some cartridges cannot be effectively covered with the palm of the hand. The test can be performed by covering the inlet opening of the cartridge with a thin latex or nitrile glove. If the facepiece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is considered satisfactory.

II. Manufacturer's Recommended User Seal Check Procedures

The respirator manufacturer's recommended procedures for performing a user seal check may be used instead of the positive and/or negative pressure check procedures provided that the employer demonstrates that the manufacturer's procedures are equally effective.

[63 FR 1152, Jan. 8, 1998]

Appendix B-2 to § 1910.134: Respirator Cleaning Procedures (Mandatory)

These procedures are provided for employer use when cleaning respirators. They are general in nature, and the employer as an alternative may use the cleaning recommendations provided by the manufacturer of the respirators used by their employees, provided such procedures are as effective as those listed here in Appendix B- 2. Equivalent effectiveness simply means that the procedures used must accomplish the objectives set forth in Appendix B-2, i.e., must ensure that the respirator is properly cleaned and disinfected in a manner that prevents damage to the respirator and does not cause harm to the user.

I. Procedures for Cleaning Respirators

A. Remove filters, cartridges, or canisters. Disassemble facepieces by removing speaking diaphragms, demand and pressure- demand valve assemblies, hoses, or any components recommended by the manufacturer. Discard or repair any defective parts.

B. Wash components in warm (43 deg. C [110 deg. F] maximum) water with a mild detergent or with a cleaner recommended by the manufacturer. A stiff bristle (not wire) brush may be used to facilitate the removal of dirt.

C. Rinse components thoroughly in clean, warm (43 deg. C [110 deg. F] maximum), preferably running water. Drain.

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

1. Hypochlorite solution (50 ppm of chlorine) made by adding approximately one milliliter of laundry bleach to one liter of water at 43 deg. C (110 deg. F); or,

2. Aqueous solution of iodine (50 ppm iodine) made by adding approximately 0.8 milliliters of tincture of iodine (6-8 grams ammonium and/or potassium iodide/100 cc of 45% alcohol) to one liter of water at 43 deg. C (110 deg. F); or,

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

E. Rinse components thoroughly in clean, warm (43 deg. C [110 deg. F] maximum), preferably running water. Drain. The importance of thorough rinsing cannot be overemphasized. Detergents or disinfectants that dry on facepieces may result in dermatitis. In addition, some disinfectants may cause deterioration of rubber or corrosion of metal parts if not completely removed.

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

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

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

[63 FR 1152, Jan. 8, 1998]

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).

1. Today's date: _____

2. Your name: _____

3. Your age (to nearest year): _____

4. Sex (circle one): Male/Female

5. Your height: _____ ft. _____ in.

6. Your weight: _____ lbs.

7. Your job title: _____

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

9. The best time to phone you at this number: _____

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

11. 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).

12. 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").

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

2. Have you **ever had** any of the following conditions?

- a. Seizures (fits): Yes/No
- b. Diabetes (sugar disease): Yes/No
- c. Allergic reactions that interfere with your breathing: Yes/No
- d. Claustrophobia (fear of closed-in places): Yes/No
- e. Trouble smelling odors: Yes/No

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

- a. Asbestosis: Yes/No
- b. Asthma: Yes/No
- c. Chronic bronchitis: Yes/No
- d. Emphysema: Yes/No
- e. Pneumonia: Yes/No
- f. Tuberculosis: Yes/No
- g. Silicosis: Yes/No
- h. Pneumothorax (collapsed lung): Yes/No
- i. Lung cancer: Yes/No

- j. Broken ribs: Yes/No
- k. Any chest injuries or surgeries: Yes/No
- l. Any other lung problem that you've been told about: Yes/No

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

- a. Shortness of breath: Yes/No
- b. Shortness of breath when walking fast on level ground or walking up a slight hill or incline: Yes/No
- c. Shortness of breath when walking with other people at an ordinary pace on level ground: Yes/No
- d. Have to stop for breath when walking at your own pace on level ground: Yes/No
- e. Shortness of breath when washing or dressing yourself: Yes/No
- f. Shortness of breath that interferes with your job: Yes/No
- g. Coughing that produces phlegm (thick sputum): Yes/No
- h. Coughing that wakes you early in the morning: Yes/No
- i. Coughing that occurs mostly when you are lying down: Yes/No
- j. Coughing up blood in the last month: Yes/No
- k. Wheezing: Yes/No
- l. Wheezing that interferes with your job: Yes/No
- m. Chest pain when you breathe deeply: Yes/No
- n. Any other symptoms that you think may be related to lung problems: Yes/No

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

- a. Heart attack: Yes/No
- b. Stroke: Yes/No
- c. Angina: Yes/No
- d. Heart failure: Yes/No
- e. Swelling in your legs or feet (not caused by walking): Yes/No
- f. Heart arrhythmia (heart beating irregularly): Yes/No
- g. High blood pressure: Yes/No
- h. Any other heart problem that you've been told about: Yes/No

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

- a. Frequent pain or tightness in your chest: Yes/No
- b. Pain or tightness in your chest during physical activity: Yes/No

- c. Pain or tightness in your chest that interferes with your job: Yes/No
- d. In the past two years, have you noticed your heart skipping or missing a beat: Yes/No
- e. Heartburn or indigestion that is not related to eating: Yes/ No
- f. Any other symptoms that you think may be related to heart or circulation problems: Yes/No

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

- a. Breathing or lung problems: Yes/No
- b. Heart trouble: Yes/No
- c. Blood pressure: Yes/No
- d. Seizures (fits): Yes/No

8. 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 9:)

- a. Eye irritation: Yes/No
- b. Skin allergies or rashes: Yes/No
- c. Anxiety: Yes/No
- d. General weakness or fatigue: Yes/No
- e. Any other problem that interferes with your use of a respirator: Yes/No

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

Questions 10 to 15 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.

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

11. Do you **currently** have any of the following vision problems?

- a. Wear contact lenses: Yes/No
- b. Wear glasses: Yes/No
- c. Color blind: Yes/No
- d. Any other eye or vision problem: Yes/No

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

13. Do you **currently** have any of the following hearing problems?

- a. Difficulty hearing: Yes/No
- b. Wear a hearing aid: Yes/No
- c. Any other hearing or ear problem: Yes/No

14. Have you **ever had** a back injury: Yes/No

15. Do you **currently** have any of the following musculoskeletal problems?

- a. Weakness in any of your arms, hands, legs, or feet: Yes/No
- b. Back pain: Yes/No
- c. Difficulty fully moving your arms and legs: Yes/No
- d. Pain or stiffness when you lean forward or backward at the waist: Yes/No
- e. Difficulty fully moving your head up or down: Yes/No
- f. Difficulty fully moving your head side to side: Yes/No
- g. Difficulty bending at your knees: Yes/No
- h. Difficulty squatting to the ground: Yes/No
- i. Climbing a flight of stairs or a ladder carrying more than 25 lbs: Yes/No
- j. 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.

1. 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

2. 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: _____

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

- a. Asbestos: Yes/No
- b. Silica (e.g., in sandblasting): Yes/No
- c. Tungsten/cobalt (e.g., grinding or welding this material): Yes/No
- d. Beryllium: Yes/No
- e. Aluminum: Yes/No
- f. Coal (for example, mining): Yes/No
- g. Iron: Yes/No
- h. Tin: Yes/No
- i. Dusty environments: Yes/No
- j. Any other hazardous exposures: Yes/No

If "yes," describe these exposures: _____

4. List any second jobs or side businesses you have: _____

5. List your previous occupations: _____

6. List your current and previous hobbies: _____

7. 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

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

9. 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: _____

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

- a. HEPA Filters: Yes/No
- b. Canisters (for example, gas masks): Yes/No
- c. Cartridges: Yes/No

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

- a. Escape only (no rescue): Yes/No
- b. Emergency rescue only: Yes/No
- c. Less than 5 hours **per week**: Yes/No
- d. Less than 2 hours **per day**: Yes/No
- e. 2 to 4 hours per day: Yes/No
- f. Over 4 hours per day: Yes/No

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

a. **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.

b. **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.

c. **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.).

13. 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: _____

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

15. Will you be working under humid conditions: Yes/No

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

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

18. 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: _____

19. 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):

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

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

You should do the following:

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

Evaluation Form

I. Program Administration

A.	Is there a written standard operating procedure for respirator use?	yes no	1 0
B.	Does the standard operating procedure contain reference to the following:		
	1. Hazard recognition/measurement criteria (TLVs, sampling)?	yes no	1 0
	2. Respirator selection criteria?	yes no	1 0
	3. Use of approved equipment only (National Institute for Occupational Safety and Health, Mine Safety and Health Administration, other standards)?	yes no	1 0
	4. Training requirements and regularity of repetition?	yes no	1 0
	5. Fit testing requirements (both qualitative and quantitative) and regularity of repetition?	yes no	1 0
	6. A stated policy on facial hair and other fitting problems?	yes no	1 0
	7. Procedures for issuing respirators to users?	yes no	1 0
	8. Procedures for inspection and maintenance of respirators?	yes no	1 0
	9. Medical evaluation of respirator users?	yes no	1 0
	10. Program evaluation criteria?	yes no	1 0
C.	Has responsibility and authority for the respiratory protection program been assigned to a single individual?	yes no	10 0
D.	Does the program administrator have sufficient knowledge of respiratory protection?	yes no	10 0
E.	Are adequate resources allocated to ensure success (budgeted money with specific expenses itemized for equipment, training, etc.)?	yes no	10 0

Total points possible:

50

Total points obtained:

--more--

II. Selection Background Information

A.	Have all toxic substances in the plant been listed and their use described (e.g., flow charts, material safety data sheets, etc.)?	yes no	5 0
B.	Have all toxic substances in the plant been sampled or in some other appropriate manner have their concentrations been determined?	yes no	5 0
C.	Have the concentrations for all toxic substances been determined within the last year or some other appropriate time period? (Verify this by examining records, etc.)	yes no	5 0
D.	Is odor threshold data, if applicable, available on all toxic substances listed in (II.,A.)?	yes no	5 0
E.	Have OSHA permissible exposure limits (PELs) or other applicable levels been identified for all toxic substances listed in (II.,A.)?	yes no	5 0
F.	Have all immediately dangerous to life and health (IDLH) situations/concentrations been identified?	yes no	5 0
G.	Have all toxic substances listed in (II.,A.) been evaluated for eye irritation potential?	yes no	5 0
H.	Have all possibly exposed employees been identified by job category, including information on job task, duration and frequency, location, and physical demands?	yes no	5 0
I.	Have all job environments been measured for temperature, relative humidity, and pressure conditions?	yes no	5 0
J.	Have all jobs been identified in terms of work load (e.g., ACGIH or other criteria)?	yes no	5 0
K.	Have all confined space situations been identified?	yes no	5 0

Total points possible:

55

Total points obtained:

--more--

III. Respirator Selection Process

A.	Has a logical sequence of criteria been applied to identify the appropriate class of respirators for each hazardous situation (i.e., is there evidence of a "decision logic")?	Yes No	20 0
B.	Have the criteria for selection included identification of the following:		
	1. Fire fighting?	Yes No	5 0
	2. Oxygen deficiency?	Yes No	5 0
	3. Emergency use?	Yes No	5 0
	4. Average concentrations and their ranges?	Yes No	5 0
	5. Immediately dangerous to life and health (IDLH) situations?	Yes No	5 0
	6. Eye irritation?	Yes No	5 0
	7. Acceptable set of assigned protection factors used (OSHA, NIOSH, etc.)?	Yes No	5 0
	8. Particulate vs. gas/vapor atmosphere? Type of atmosphere, i.e., dust, fume, mist, gas/vapor, or combination?	Yes No	5 0
	9. Size distribution determined for aerosol exposures?	Yes No	5 0
	10. Escape use only?	Yes No	5 0
	11. Warning properties of the material at or below PEL?	Yes No	5 0
	12. Service life information for gas/vapor sorbents?	Yes No	5 0
	13. Possibility of mixtures and how the PEL may change for mixtures?	Yes No	5 0
	14. Flammability of contaminants (lower explosive limit listed)?	Yes No	5 0
	15. Health effects from overexposure?	Yes No	5 0

Total points possible:

95

Total points obtained:

--more--

IV. Training

A.	Has a training program been established for all employees required to wear respirators in any situation?	yes no	20 0
B.	Does the training program contain the following:		
	1. Hands-on opportunities?	yes no	2 0
	2. Fitting demonstrations?	yes no	2 0
	3. Familiarization in clean environment?	yes no	2 0
	4. Wear in test environment?	yes no	2 0
	5. Qualitative fit procedures?	yes no	2 0
	6. Quantitative fit procedures?	yes no	2 0
	7. Demonstration of cleaning?	yes no	2 0
	8. Demonstration of inspection procedures?	yes no	2 0
	9. Description of capabilities and limitations of each respirator class?	yes no	2 0
	10. Description of contaminants, levels, and the general nature of their hazards?	yes no	2 0
	11. Description of other controls available?	yes no	2 0
	12. Explanation of why respiratory protection is necessary?	yes no	2 0
	13. Description of consequences in the event of improper use or failure?	yes no	2 0
	14. Description of selection criteria used for respiratory protection chosen?	yes no	2 0
	15. Recognition and handling of emergencies	yes no	2 0
C.	Are records of employee attendance at training sessions kept?	yes no	10 0

Total points possible:

60

Total points obtained:

--more--

V. Fit Tests

A.	Are fit tests performed by a qualified person on a regular basis?	yes no	20 0
B.	Can employees demonstrate negative and positive pressure tests?	yes no	10 0
C.	Do qualitative fit tests consist of the following:		
	1. Do employees understand the purpose of such tests?	yes no	10 0
	2. Is a valid test used (isoamyl or saccharin or bitrex or smoke)?	yes no	10 0
	3. Are the protocols for test preparation properly followed?	yes no	10 0
	4. Is screening (odor or taste) performed prior to the test?	yes no	10 0
	5. Is the employee given a choice of several manufacturers' respirators in a range of models and sizes?	yes no	10 0
	6. Are records of qualitative fit test results available?	yes no	10 0
D.	Do quantitative fit tests consist of the following:		
	1. Do employees understand the purpose of such tests?	yes no	10 0
	2. Does testing equipment conform to appropriate standards?	yes no	10 0
	3. Is test equipment run and maintained properly?	yes no	10 0
	4. Is a range of respirators, models, and sizes available?	yes no	10 0
	5. Are records of quantitative fit test results available?	yes no	10 0

Total points possible:

120

Total points obtained:

--more--

VI. Inspection, Cleaning, Maintenance, Storage

A.	Are respiratory protection devices regularly inspected (i.e., schedule, records, etc)?	yes no	10 0
B.	Does inspection include the following?		
	1. Visual checks for damage?	yes no	5 0
	2. Ascertainment of proper functioning?	yes no	5 0
C.	Are respirators regularly cleaned and disinfected?	yes no	10 0
D.	Is all maintenance performed by trained personnel?	yes no	5 0
E.	Are respirators properly stored when not in use?	yes no	10 0

Total points possible: 45

Total points obtained: _____

VII. Medical Evaluation

A.	Is a medical status questionnaire used to evaluate each person's physiological ability to wear a respirator?	yes no	5 0
B.	Is each respirator user's pulmonary function monitored initially and regularly (annually) thereafter?	yes no	5 0
C.	If abnormal results occur, is the user referred to a physician qualified in occupational health and respirator use?	yes no	5 0
D.	Are standards outlined and used for pulmonary performance?	yes no	5 0

Total points possible: 20

Total points obtained: _____

--more--

Program Evaluation

Section Number	Total Points Possible	Scale Points	Scale Evaluation (see below)
I	50	0-20	1
		21-30	2
		31-40	3
		41-50	4
II	55	0-20	1
		21-30	2
		31-40	3
		41-55	4
III	95	0-40	1
		41-60	2
		61-85	3
		86-95	4
IV	60	0-12	1
		13-36	2
		37-48	3
		49-60	4
V	120	0-50	1
		51-70	2
		71-95	3
		96-120	4
VI	45	0-20	1
		21-30	2
		31-40	3
		41-45	4
VII	20	0-5	1
		6-10	2
		11-15	3
		16-20	4
ALL SECTIONS	445	0-18-	1
		181-275	2
		276-365	3
		366-445	4

Scale: 1 = Unacceptable
 2 = Serious deficiencies
 3 = Some deficiencies
 4 = Generally acceptable

**One Hour Safety
Presentation**

One Hour Safety Presentation

The main goal of the Division of Safety & Hygiene is the reduction of accidents and illnesses in the workplace. Toward this goal, the One Hour Safety presentation is designed to support the delivery of a presentation to co-workers in your workplace to help them understand and promote safer and healthier work environments. It is recommended that you take the DSH Training Center course as a background for using One Hour Safety Presentation to train others at your workplace. Call 1-800-OHIOBWC, option 2, 2, 2 for class dates and locations.

The One Hour Safety Presentation contains:

- Transparency Masters from which films can be made to use on an overhead projector,
- Instructor Notes which gives the instructor suggestions and script notations to use during the presentation, and
- Student Handouts which can be copied for those attending the presentation.

Materials are included for a one-hour presentation on each of these topics:

- ✓ Accident Analysis
- ✓ Bloodborne Pathogens
- ✓ Effective Safety Teams
- ✓ Enhancing Safety through a Drug-Free Workplace
- ✓ Ergonomics Basic Principles
- ✓ Ergonomics Developing an Effective Process
- ✓ Hazard Communication
- ✓ Lockout/Tagout and Safety-related Work Practices
- ✓ Machine Guarding Basics
- ✓ Measuring Safety Performance
- ✓ Powered Industrial Trucks Training Program
- ✓ Respiratory Protection
- ✓ Violence in the Workplace

Applications used:

- 1) Text documents (ending in .txt) can be opened with any word processing program.
- 2) Microsoft PowerPoint slides (ending in .ppt) can be opened with the Microsoft PowerPoint program. If you do not have PowerPoint and you do have Windows 95, 98, 2000 or Windows NT operating system, you can view the PowerPoint slides by downloading a free PowerPoint Viewer from the following website:
<http://office.microsoft.com/downloads/default.aspx?Product=PowerPoint&Version=95|97|98|2000|2002&Type=Converter|Viewer>
- 3) Adobe Reader document (ending in .pdf) contains the One Hour Safety Presentation in read-only format. It can be opened when you download Adobe Reader, which is available free of charge at the following website:
<http://www.adobe.com/products/acrobat/readstep2.html>

If you have comments or questions about these materials for One Hour Safety Presentation, please e-mail us: OCOSHTrng@bwc.state.oh.us

Transparency Masters

Respirator Use

- Standard Overview
- Inspection
- Cleaning
- Storage
- Donning / Doffing
- Uses / Limitations

The Big Question

Is the use of respirators required?

Over-exposure?

Company policy?

Review of 1910.134 Required Use of Respirators

Program elements:

- Selection procedures
- Medical Evaluations
- Fit testing procedures for tight-fitting respirators
- Proper use procedures - routine & emergency

Review of 1910.134

Required Use (continued)

- Procedures & schedules for maintenance
- Supplied air quality & quantity
- Hazards Training - routine & emergency
- Respirator use training
- Program auditing

Review of 1910.134 Voluntary Use

- Medical evaluations
- Maintenance, Cleaning, Storage
- Appendix D

**Review of 1910.134
Voluntary Use
filtering facepiece only**

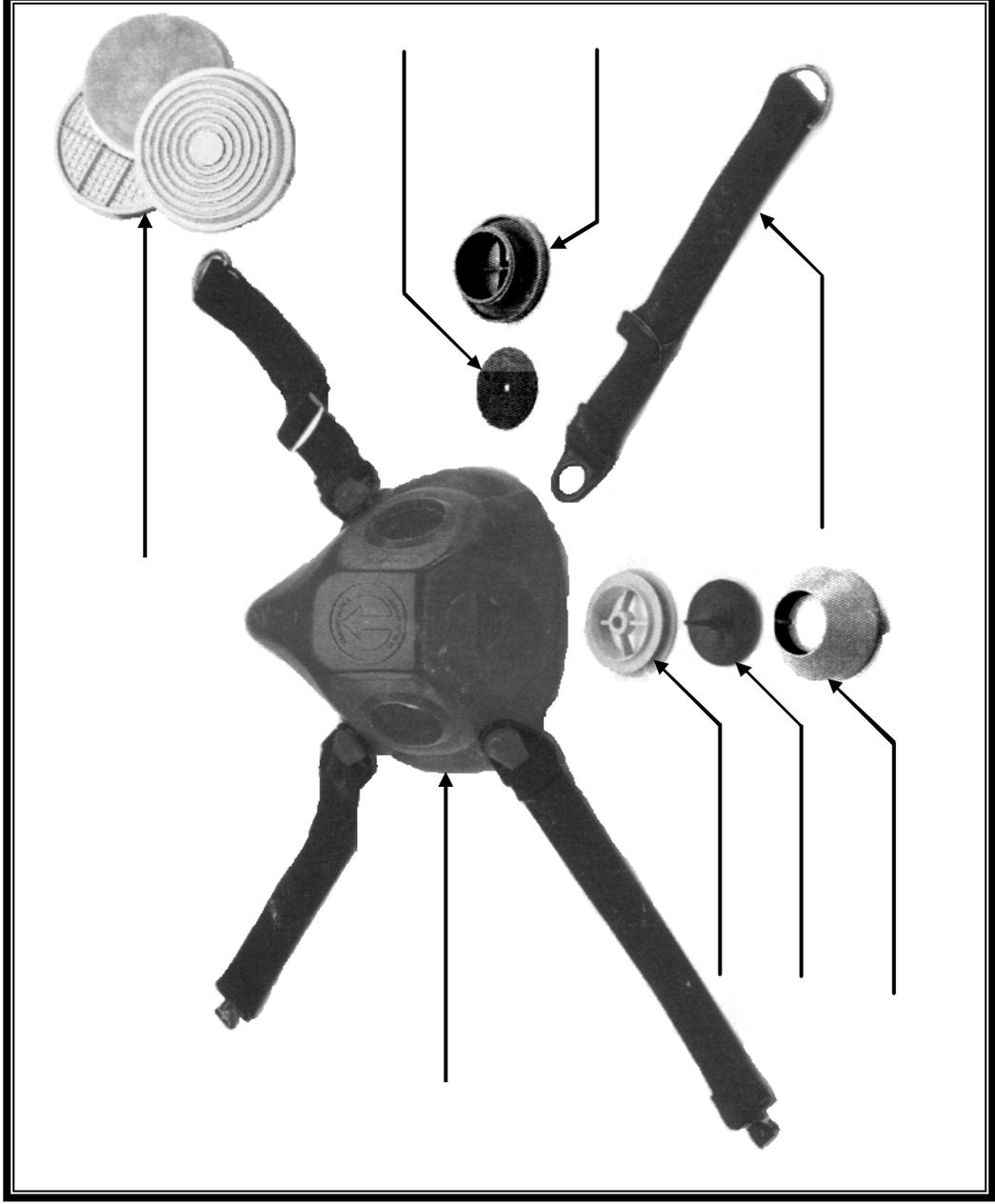
Appendix D only:

- **Read and Heed all instructions**
- **Use approved respirators**
- **Properly selected**
- **Keep track of your respirator**

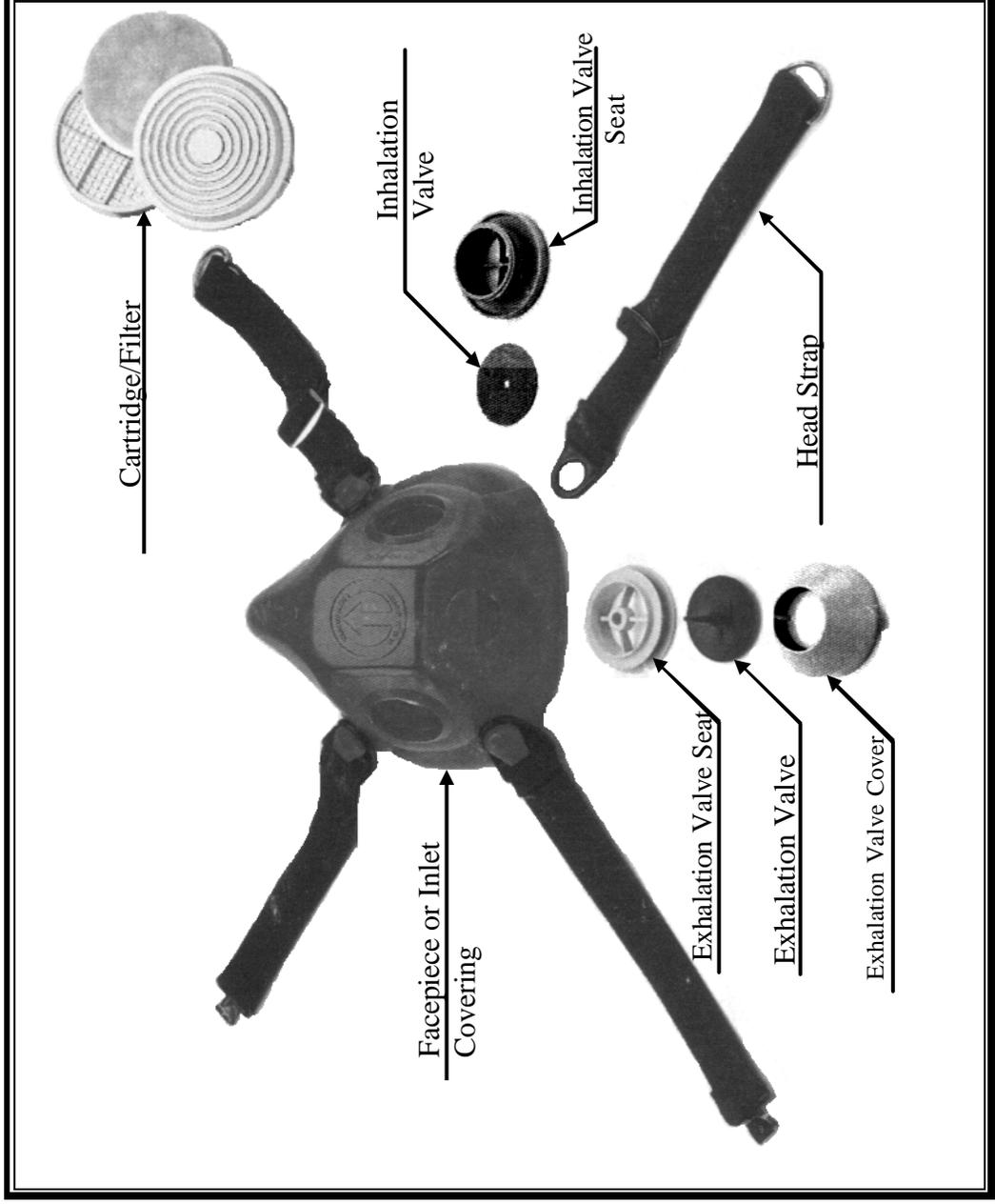
Inspection

- Dirt
- Cracks
- Tears
- Holes
- Distortion
- Broken parts
- Missing parts
- Elasticity
- Corrosion
- Valve test

Anatomy of a half-mask respirator



Anatomy of a half-mask respirator



What do you know about respirator cleaning?

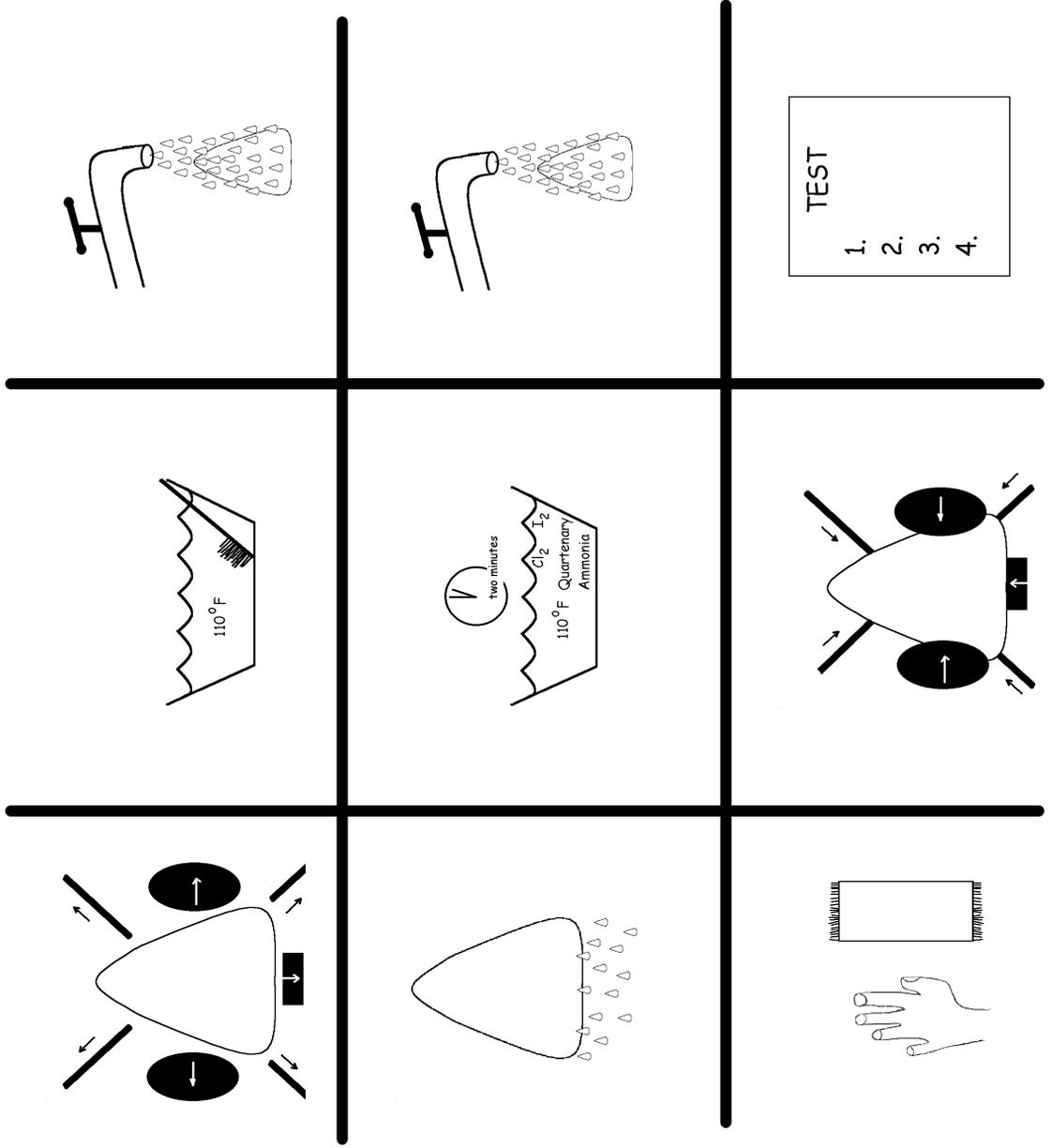
What do you know about respirator
cleaning?

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____

Cleaning

- Dismantle
- Wash
- Rinse
- Drain
- Sanitize
- Rinse
- Dry
- Reassemble
- Test

Cleaning



TEST

- 1.
- 2.
- 3.
- 4.

Storage

- Dust
- Sunlight
- Damaging chemicals
- Heat
- Extreme cold
- Excessive moisture

Donning / Doffing

- Inspection
- Adjust straps, out
- Hook the bottom straps, snug slightly
- Seat facepiece
- Hook the top straps, snug slightly
- Snug straps
- Perform user seal checks (+ and -)

Uses / Limitations

Never use an air purifying respirator:

- in an OXYGEN deficient atmosphere;
- in an IDLH atmosphere;
- for ABRASIVE BLASTING;
- for FIRE FIGHTING;
- which is not APPROVED for the contaminant of concern;
- with FACIAL HAIR.

Instructor Notes

Thank you for your interest in teaching the basics of Respiratory Protection to your employees and for promoting self-sufficiency on behalf of the Division of Safety & Hygiene.

A few points to keep in mind while teaching this class to your employees.

Try to do everything you can to get your students “involved” with the information that you will be presenting. This means using actual work place examples wherever possible. Try to use your own respirators for demonstrations, inspections, and cleaning steps exercises and refer to your company specific procedures when at all possible.

If possible, incorporate some exercises into your training. Respirator inspections, exercises on identifying the parts of a half-mask respirator, and the cleaning steps exercise are just samples of things that you can use. The key is to get your class involved so that they are not just listening to you lecture.

Encourage questions and repeat questions for clarity to be sure that everyone has heard and understood. Even if you know the answer, a good technique is to ask the class if anyone can answer the question. On questions where you’re not sure of the answer or there is disagreement within the class, tell the class that you’ll check on it during a break or as soon after the class as possible. Follow-up and make sure everyone gets the information.

Remember, your goal is to teach your employees to be safe and to provide accurate information about respirators your specific respirator program.

Respirator Use

- Standard Overview
- Inspection
- Cleaning
- Storage
- Donning / Doffing
- Uses / Limitations

Standard Overview

\$100 question..... Is the use of a respirator required

Program elements (for required use) nine steps

Program elements (for voluntary use) three steps

Program elements (voluntary use, filtering facepieces only) Appendix D

The Big Question

Is the use of respirators required?

Over-exposure?
Company policy?

Required use of respirators comes in two versions.

1. Over-exposure to something
2. Employer requirement.

Review of 1910.134 Required Use of Respirators

Program elements:

- Selection procedures
- Medical Evaluations
- Fit testing procedures for tight-fitting respirators
- Proper use procedures - routine & emergency

If the use of a respirator is **REQUIRED**, all nine elements must be written.

Review of 1910.134 Required Use (continued)

- Procedures & schedules for maintenance
- Supplied air quality & quantity
- Hazards Training - routine & emergency
- Respirator use training
- Program auditing

Review of 1910.134 Voluntary Use

- Medical evaluations
- Maintenance, Cleaning, Storage
- Appendix D

Voluntary use of respiratory protection requires a three step program.
These components must have written work site specific procedures.

Medical evaluations: Appendix C the Questionnaire

Maintenance, Cleaning, & Storage WRITTEN PROCEDURES

Appendix D (INFO also on next slide)

Read and Heed all instructions

Use approved respirators

Properly selected

Keep track of your respirator

**Review of 1910.134
Voluntary Use
filtering facepiece only**

Appendix D only:

- Read and Heed all instructions
- Use approved respirators
- Properly selected
- Keep track of your respirator

Read and Heed all instructions.....

Manufacturers warnings and instruction given during training

Use approved respirators against the contaminant of concern.....

NIOSH approved

42 CFR part 84

Properly selected.....

Do NOT wear your respirator into atmospheres containing contaminants for which your respirator is not designed to protect against.....

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

Inspection

- Dirt
- Cracks
- Tears
- Holes
- Distortion
- Broken parts
- Missing parts
- Elasticity
- Corrosion
- Valve test

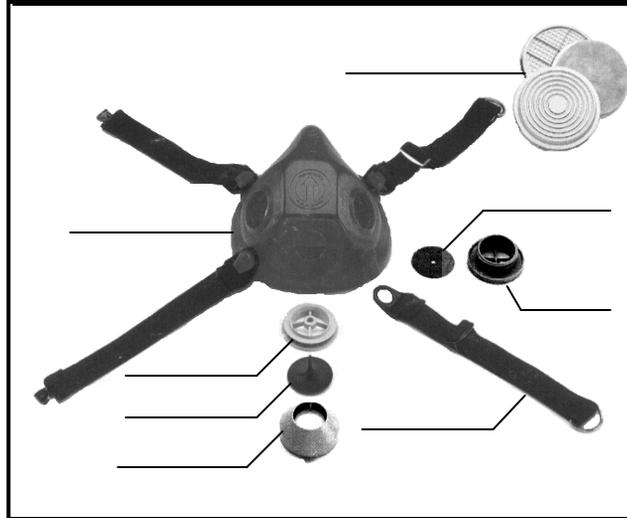
Have the trainees bring their respirators to the training session. They can be inspected as a hands on exercise during your training.

It would also be prudent to introduce the students to your specific inspection form(s). Direction should also be given at this time on the procedures for what to do if and when the respirators need to be maintained as well as what to do with their completed inspection forms.

Digital photos can also be used to supplement this portion of the training.

Valve test = the rolling up of the inhalation valve and dropping it on the table top to see if it flexes back.

Anatomy of a half-mask respirator



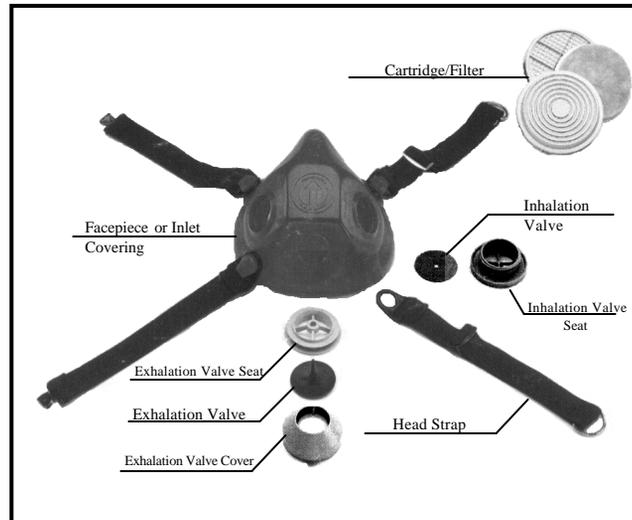
Either hand out the Anatomy of a Half-mask Respirator work sheets and let the students work in small groups to attempt to name as many of the parts of the respirator as possible

OR

just use a pointer and ask them to tell you what the name of the part is.

Note: The work sheet is a separate word document included at the end of the instructor's notes pages.

Anatomy of a half-mask respirator



What do you know about respirator cleaning?

What do you know about respirator
cleaning?

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____

Either hand out the worksheet, What do you Know About Respirator Cleaning and let the students work in small groups to attempt to list as many of the steps in cleaning as possible

OR

have them name as many of the steps as they can.

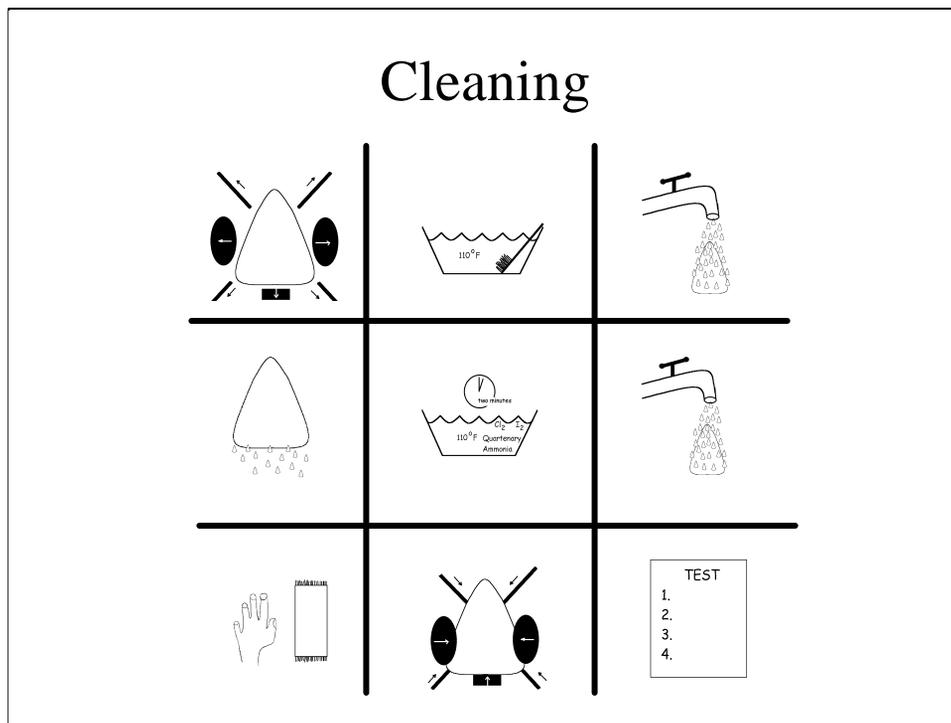
Note: The work sheet is a separate word document included at the end of the instructor's notes pages.

Cleaning

- Dismantle
- Wash
- Rinse
- Drain
- Sanitize
- Rinse
- Dry
- Reassemble
- Test

From Appendix B2

The window paning exercise is on the next slide.



Either use this slide as a VISUAL reinforcement of the steps in cleaning, or impress them with your artistic talents and draw it on the board or flip chart page as they recite the steps.

Small group exercise..... Use the form, what do you know about cleaning respirators.

Step 1: Dismantle the respirator

Step 2: Wash the respirator in a mild detergent, with a soft bristled brush, maximum temperature 110°F

Step 3: Rinse

Step 4: drain the excess water

Step 5: Sanitize, chlorine, iodine (recipes in Appendix B), TWO minutes, maximum temperature 110°F

Step 6: Rinse

Step 7: Hand or air dry

Step 8: Reassemble the unit

Step 9: Test the valves and connections

Storage

- Dust
- Sunlight
- Damaging chemicals
- Heat
- Extreme cold
- Excessive moisture

IMPORTANT: When a respirator is not in use, it shall be properly stored.

Storage of freshly cleaned respirators in heat sealed or reusable plastic bags or air-tight plastic (tupperware) containers and not laying around on the top of a bench or hanging on a peg-board.

Donning / Doffing

- Inspection
- Adjust straps, out
- Hook the bottom straps, snug slightly
- Seat facepiece
- Hook the top straps, snug slightly
- Snug straps
- Perform user seal checks (+ and -)

MUY MUY IMPORTANTE.....

CHECK THE SHEET THAT CAME WITH THE RESPIRATORS USED IN YOUR OPERATION TO ENSURE NO STEPS HAVE BEEN OMITTED.

These are the steps most commonly followed in putting a respirator on.

This can be done either as a demonstration by the instructor or having someone from the audience don a respirator as the instructor directs.

Remember to mention the USER SEAL CHECKS Appendix B1

Uses / Limitations

Never use an air purifying respirator:

- in an OXYGEN deficient atmosphere;
- in an IDLH atmosphere;
- for ABRASIVE BLASTING;
- for FIRE FIGHTING;
- which is not APPROVED for the contaminant of concern;
- with FACIAL HAIR.

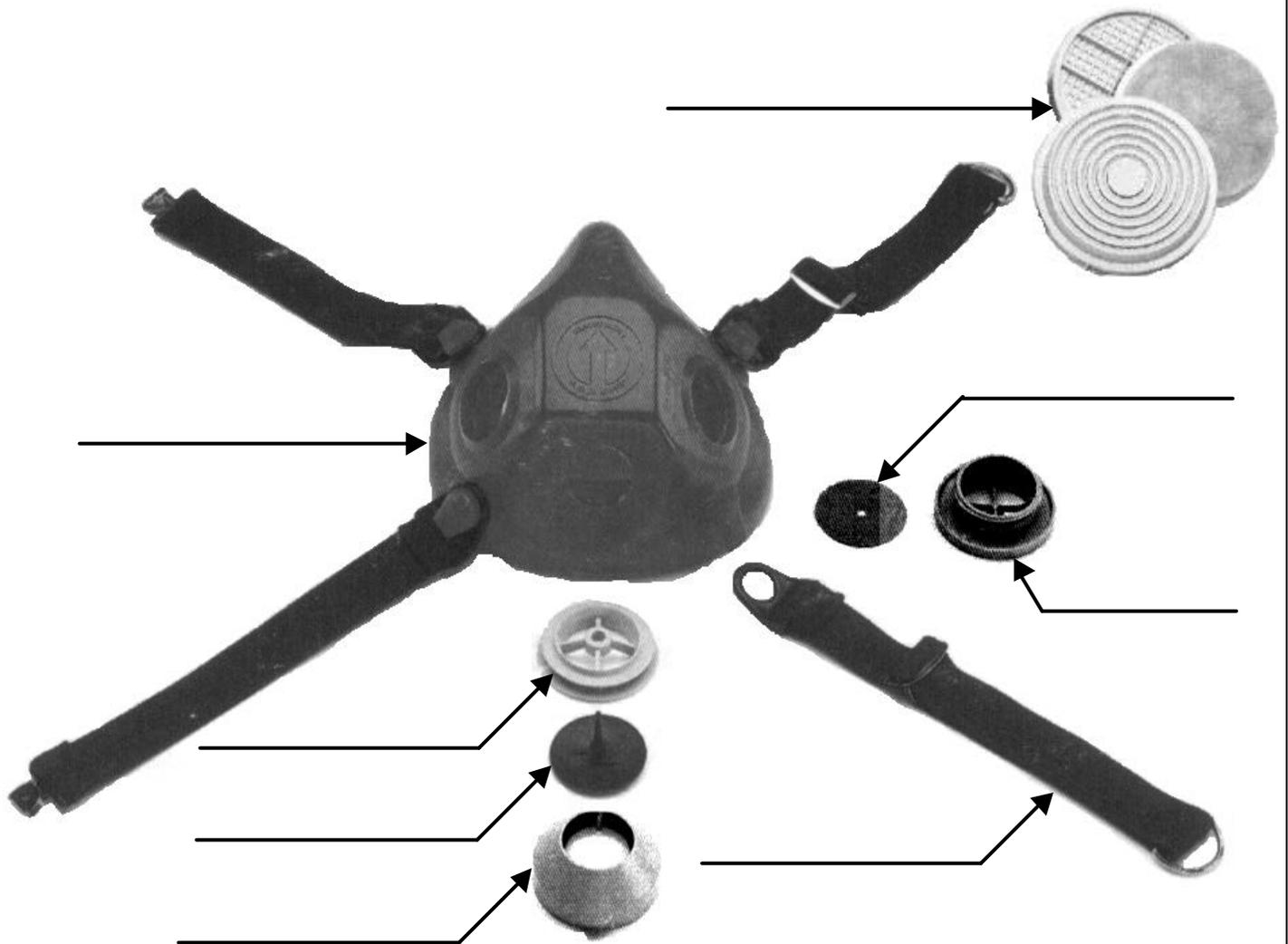
IMPORTANT STUFF.....

Add any other items that apply at your workplace.

ie. eating, drinking, smoking restrictions, areas where oxygen deficiencies may be encountered,

WHO to contact if the users have any questions.....

Anatomy of a half-mask respirator



What do you know about respirator cleaning?

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

Respiratory Protection Frequently Asked Questions

Adapted from *NIOSH Guide to the Selection and Use of Particulate Respirators Certified Under 42 CFR 84* [DHHS (NIOSH) Publication No. 96-101] and *Protect Yourself Against Tuberculosis – A Respiratory Protection Guide for Health Care Workers* [DHHS (NIOSH) Publication No. 96-102].

Q: What is a respirator?

A: A respirator is a protective facepiece, hood or helmet that is designed to protect the wearer against a variety of harmful airborne agents.

Q: When is the use of respirators required?

A: OSHA's respirator standard, 29 CFR 1910.134, requires the use of respirators to protect employees from breathing contaminated and/or oxygen-deficient air when effective engineering controls are not feasible, or while they are being instituted. Several other OSHA regulations also require the use of respirators.

Q: Can any respirator be used?

A: No, respirators shall be selected on the basis of hazards to which the worker is exposed (i.e., particulates, vapors, oxygen-deficiency, or combination). Also, OSHA requires the use of certified respirators.

Q: Who certifies respirators?

A: The National Institute for Occupational Safety and Health (NIOSH).

Q: How can a certified respirator be recognized?

A: On July 10, 1995, 30 CFR Part 11 certification procedures were replaced by 42 CFR Part 84 procedures. Under the 30 CFR Part 11 approval system, manufacturers were required to mark cartridges and filters with an abbreviated label that included a NIOSH/MSHA approval number ("TC number"). Under the 40 CFR Part 84 approval system, cartridges and filters are no longer marked with a "TC number". Instead, they are marked with "NIOSH", the manufacturer's name and part number, and an abbreviation to indicate the cartridge (e.g., OV, CL) or filter (e.g., N95, P100) type. All cartridges and filters are to be supplied with a matrix approval label, usually as an insert in the box. This label shows the NIOSH approved configurations and includes the "TC number", component parts, and cautions and use limitations. Non-powered particulate respirators that were approved under 30 CFR Part 11 and use the "old" labeling can be manufactured and sold until July 10, 1998. Distributors will be able to sell them and end-users will be able to use them until their inventories are depleted.

Q: Which class of Part 84 respirator should be used where a particular OSHA standard requires the use of a respirator with HEPA filtration?

A: Where workers are exposed to a hazard that would require the use of a respirator with HEPA filtration, the appropriate class of respirator under the 42 CFR Part 84 certification is the Type 100 (N100, R100, or P100).

Q: Why is a formal respirator program needed?

A: A respirator program increases the chances of using a respirator correctly. A respirator will only protect if it is used correctly. Also, OSHA requires a number of written elements for all respiratory protection programs.

Q: Who is in charge of the respirator program?

A: The program must be administered by a trained program administrator who is qualified and knowledgeable in respiratory protection to run all aspects of the program

Q: What do employees need to know about the respirator program?

A: Employers must establish and implement a written respiratory protection program with worksite-specific procedures and elements for required respirator use. The provisions of the program include procedures for selection, medical evaluation, fit testing, training, use and care of respirators.

Q: How is the proper respirator size determined?

A: Proper respirator size is determined through a fit test. Employees using negative or positive pressure tight-fitting facepiece respirators must pass an appropriate fit test using the procedures detailed in OSHA's respirator standard.

Q: Can employees check the fit of their own respirator?

A: Yes, employees using tight-fitting facepiece respirators are required to perform a user seal check each time they put on the respirator. They must use the procedures in Appendix B-1 of 29 CFR 1910.134 or procedures recommended by the respirator manufacturer that the employer demonstrates are as effective as OSHA's procedures. Note that a *fit test* is a method used to select the right size respirator for the user. A *user seal check* is a method to verify that the user has correctly put on the respirator and adjusted it to fit properly, as illustrated below.

Q: When is respirator fit testing required?

A: Fit testing of all negative or positive pressure tight-fitting facepiece respirators is required prior to initial use, whenever a different respirator facepiece is used, and at least annually thereafter. An additional fit test is required whenever there are changes in the user's physical condition that could affect respirator fit (e.g., facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight). The employer must be fit tested with the same make, model, style, and size of respirator that will be used.

Q: What can be done if an employee has a very small face and has trouble being fit tested for a respirator?

A: Manufacturers make several different sizes. Respirators may also vary in size from manufacturer to manufacturer. Users may be able to get a better fit by trying a respirator made by another manufacturer. In some cases, the use of powered air-purifying respirators may be appropriate. Employers must help employees find a suitable respirator.

Q: Must employees see a doctor before they use a respirator?

A: The employer must provide a medical evaluation to determine the employee's ability to use a respirator before the employee is fit tested or required to use the respirator in the workplace. Not all workers must be examined by a doctor. A physician or other licensed health care professional must perform the medical evaluation using the medical questionnaire contained in Appendix C of 29 CFR 1910.134 or an initial medical examination that obtains the same information.

Q: What maintenance and care is required for respirators?

A: The employer must provide for the cleaning and disinfecting, storage, inspection, and repair of respirators used by employees according to the procedures in 29 CFR 1910.134.

**Q: Can a respirator be used by more than one person?
How often should it be cleaned and disinfected?**

A: Disposable respirators cannot be disinfected, and are therefore assigned to only one person. Disposable respirators must be discarded if they are soiled, physically damaged, or reach the end of their service life. Replaceable filter respirators may be shared, but must be thoroughly cleaned and disinfected after each use before being worn by a different person, using the procedures in Appendix B-2 of 29 CFR 1910.134, or equally effective procedures recommended by the manufacturer.

Q: How long can a particulate respirator be used before it must be discarded?

A: Respirators with replaceable filters are reusable, and a respirator classified as disposable may be reused by the same worker as long as it functions properly. All filters must be replaced whenever they are damaged, soiled, or causing noticeably increased breathing resistance (e.g., causing discomfort to the wearer). Before each use, the outside of the filter material should be inspected. If the filter material is physically damaged or soiled, the filter should be changed (in the case of respirators with replaceable filters) or the respirator discarded (in the case of disposable respirators).

Employers must develop standard operating procedures for storing, reusing, and disposing of respirators that have been designated as disposable and for disposing of replaceable filter elements.

Q: What is the proper way to store a respirator that is used routinely?

A: Respirators must be stored to protect them from damage, contamination, dust, sunlight, extreme temperatures, excessive moisture, and damaging chemicals. They must also be packed or stored to prevent deformation of the facepiece and exhalation valve. A good method is to place them in individual storage bins. Keep in mind that respirator facepieces will become distorted and the straps will lose their elasticity if hung on a peg for a long time. Check for these problems before each use. Storing the respirator in a plastic sealable bag after use is not considered a good practice. The respirator may be damp after use and sealing prevents drying and encourages microbial growth. If plastic bags are used, respirators must be allowed to dry before storage.

Q: Are there any additional requirements for the storage of emergency respirators?

A: Yes, emergency respirators must be kept accessible to the work area and stored in compartments or in covers that are clearly marked as containing emergency respirators, and stored in accordance with any applicable manufacturer instructions.

Q: What are the employer's obligations when respiratory protection is not required but employees wear respirators on their own accord?

A: The employer must implement those elements of the written respiratory protection program necessary to ensure that any employee using a respirator voluntarily is medically able to use that respirator, and that the respirator is cleaned, stored, and maintained so its use does not present a health hazard to the user. Also, employers must provide the voluntary respirator users with the information contained in Appendix D of 29 CFR 1910.134.

Employers are not required to include in a written respiratory program those employees whose only use of respirators involves the voluntary use of filtering facepieces (dust masks).

Q: Is training required before a respirator is used?

A: Yes, training must be provided to employees who are required to use respirators. The training must be comprehensive, understandable, and recur annually, and more often if necessary. This training should include at a minimum:

- Why the respirator is necessary and how improper fit, use, or maintenance can compromise its protective effect
- Limitations and capabilities of the respirator
- Effective use in emergency situations
- How to inspect, put on and remove, use and check the seals
- Maintenance and storage
- Recognition of medical signs and symptoms that may limit or prevent effective use
- General requirements of OSHA's respirator standard, 29 CFR 1910.134

Q: What can be done if employees find it difficult to talk with co-workers when wearing a respirator?

A: Some respirators may interfere with speech more than others. Devices that enhance speech communication are available. Ask your program administrator if there are alternatives.

Q: If employees have a beard or moustache, is their respirator still effective?

A: Tight-fitting facepiece respirators must not be worn by employees who have facial hair that comes between the sealing surface of the facepiece and the face or that interferes with valve function. Respirators that do not rely on a tight face seal, such as hoods or helmets, may be used by bearded individuals.

Q: Can employees wear glasses while wearing a respirator?

A: Yes, but if an employee wears corrective glasses or goggles or other personal protective equipment, the employer must ensure that such equipment is worn in a manner that does not interfere with the seal of the facepiece to the face of the user. Kits are available from all respirator manufacturers that allow the mounting of prescription lenses inside the respirator.

Contact lenses can be worn with any type of respirator, but their use is not recommended in dusty atmospheres while wearing a half-mask facepiece.

Q: If employees get a rash when they wear a respirator with a latex seal, how can this be prevented?

A: Users might have an allergy or sensitivity to the latex or its additives used in the manufacture of some respirators. Changing to a respirator using a silicone-based compound for the face seal, or a respirator that doesn't have a face seal (like a hooded PAPR) may solve the problem. Employers must help employees find a respirator that does not cause this problem.

Student Handouts

Respirator Use

- Standard Overview
- Inspection
- Cleaning
- Storage
- Donning / Doffing
- Uses / Limitations

The Big Question

Is the use of respirators required?

- Over-exposure?
- Company policy?

Review of 1910.134 Required Use of Respirators

Program elements:

- Selection procedures
- Medical Evaluations
- Fit testing procedures for tight-fitting respirators
- Proper use procedures - routine & emergency

**Review of 1910.134
Required Use (continued)**

- Procedures & schedules for maintenance
- Supplied air quality & quantity
- Hazards Training - routine & emergency
- Respirator use training
- Program auditing

**Review of 1910.134
Voluntary Use**

- Medical evaluations
- Maintenance, Cleaning, Storage
- Appendix D

**Review of 1910.134
Voluntary Use
filtering facepiece only**

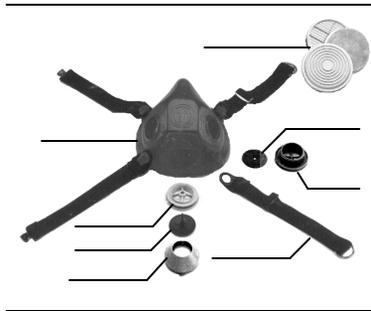
Appendix D only:

- Read and Heed all instructions
- Use approved respirators
- Properly selected
- Keep track of your respirator

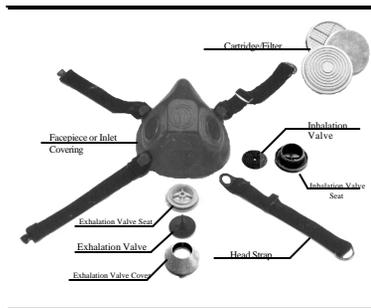
Inspection

- Dirt
- Cracks
- Tears
- Holes
- Distortion
- Broken parts
- Missing parts
- Elasticity
- Corrosion
- Valve test

Anatomy of a half-mask respirator



Anatomy of a half-mask respirator



What do you know about respirator cleaning?

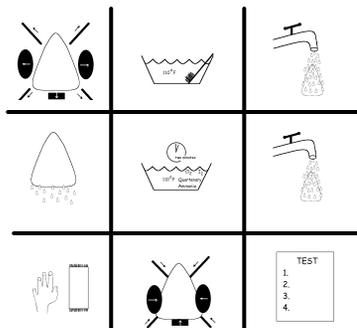
What do you know about respirator cleaning?

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____

Cleaning

- Dismantle
- Wash
- Rinse
- Drain
- Sanitize
- Rinse
- Dry
- Reassemble
- Test

Cleaning



Storage

- Dust
- Sunlight
- Damaging chemicals
- Heat
- Extreme cold
- Excessive moisture

Donning / Doffing

- Inspection
- Adjust straps, out
- Hook the bottom straps, snug slightly
- Seat facepiece
- Hook the top straps, snug slightly
- Snug straps
- Perform user seal checks (+ and -)

Uses / Limitations

- Never use an air purifying respirator:
- in an OXYGEN deficient atmosphere;
 - in an IDLH atmosphere;
 - for ABRASIVE BLASTING;
 - for FIRE FIGHTING;
 - which is not APPROVED for the contaminant of concern;
 - with FACIAL HAIR.

GLOSSARY OF COMMON TERMS

Air-Purifying Respirator: A respirator with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element. *OSHA Definition*

Assigned Protection Factor (APF): See Protection Factors. *NIOSH Definition*

Atmosphere-Supplying Respirator: 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. *OSHA Definition*

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

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

Demand Respirator: An atmosphere-supplying respirator that admits breathing air to the facepiece only when a negative pressure is created inside the facepiece by inhalation. *OSHA Definition*

Disposable Respirators: A respirator that is discarded after the end of its recommended period of use, after excessive resistance or physical damage, or when odor breakthrough or other warning indicators render the respirator unsuitable for further use. *NIOSH Definition*

Dust: A solid, mechanically produced particle with a size ranging from submicroscopic to macroscopic. *NIOSH Definition*

Emergency Respirator Use Situation: A situation that requires the use of respirators due to the unplanned generation of a hazardous atmosphere (often of unknown composition) caused by an accident, mechanical failure, or other means and that requires evacuation of personnel or immediate entry for rescue or corrective action. *NIOSH Definition*

Emergency Situation: 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. *OSHA Definition*

Employee Exposure: Exposure to a concentration of an airborne contaminant that would occur if the employee were not using respiratory protection. *OSHA Definition*

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

Escape Gas Mask: A gas mask that consists of a half-mask facepiece or mouthpiece, a canister, and associated connections, and that is designed for use during escape-only from hazardous atmospheres. *NIOSH Definition*

Escape Only Respirator: Respiratory devices that are designed for use only during escape from hazardous atmospheres. *NIOSH Definition*

Escape-Only Respirator: A respirator intended to be used only for emergency exit. *OSHA Definition*

Filter or Air-Purifying Element: A component used in respirators to remove solid or liquid aerosols from the inspired air. *OSHA Definition*

Filtering Facepiece: A particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium. (See Single-Use Dust or Dust and Mist Respirators and Disposable Respirators.) *NIOSH Definition*

Filtering Facepiece (Dust Mask): A negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium. *OSHA Definition*

Fit Factor: A quantitative measure of the fit of a specific respirator facepiece to a particular individual. *NIOSH Definition*

Fit Factor: 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. *OSHA Definition*

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.) *OSHA Definition*

Fume: A solid condensation particulate, usually of a vaporized metal. *NIOSH Definition*

Gas: An aeriform fluid that is in a gaseous state at standard temperature and pressure. *NIOSH Definition*

Helmet: A rigid respiratory inlet covering that also provides head protection against impact and penetration. *OSHA Definition*

High-Efficiency Particulate Air (Hepa) Filter: 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. *OSHA Definition*

Hood: Means a respiratory inlet covering that completely covers the head and neck and may also cover portions of the shoulders and torso. *OSHA Definition*

Immediately Dangerous to Life or Health (IDLH): Acute respiratory exposure that poses an immediate threat of loss of life, immediate or delayed irreversible adverse effects on health, or acute eye exposure that would prevent escape from a hazardous atmosphere. *NIOSH Definition*

Immediately Dangerous to Life or 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. *OSHA Definition*

Interior Structural Firefighting: The physical activity of fire suppression, rescue or both, inside of buildings or enclosed structures which are involved in a fire situation beyond the incipient stage. (See 29 CFR 1910.155) *OSHA Definition*

Loose-Fitting Facepiece: A respiratory inlet covering that is designed to form a partial seal with the face. *OSHA Definition*

Maximum Use Concentration (MUC): [Reserved] *OSHA Definition*

Mist: A liquid condensation particulate. *NIOSH Definition*

Negative Pressure Respirator (Tight Fitting): A respirator in which the air pressure inside the facepiece is negative during inhalation with respect to the ambient air pressure outside the respirator. *OSHA Definition*

Orinasal Respirator: A respirator that covers the nose and mouth and that generally consists of a quarter- or half- facepiece. *NIOSH Definition*

Oxygen Deficient Atmosphere: An atmosphere with an oxygen content below 19.5% by volume. *OSHA Definition*

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. *OSHA Definition*

Planned or Unplanned Entry into an IDLH Environment, an Environment of Unknown Concentration of Hazardous Contaminant, or an Environment of Unknown Composition: A situation in which respiratory devices are recommended to provide adequate protection to workers entering an area where the contaminant concentration is above the IDLH or is unknown. *NIOSH Definition*

Positive Pressure Respirator: A respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator. *OSHA Definition*

Potential Occupational Carcinogen: Any substance, or combination or mixture of substances, which causes an increased incidence of benign and/or malignant neoplasms, or a substantial decrease in the latency period between exposure and onset of neoplasms in humans or in one or more experimental mammalian species as the result of any oral, respiratory, or dermal exposure, or any other exposure which results in the induction of tumors at a site other than the site of administration. This definition also includes any substance that is metabolized into one or more potential occupational carcinogens by mammals (29 CFR 1990.103, OSHA Cancer Policy). *NIOSH Definition*

Powered Air-Purifying Respirator (PAPR): An air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering. *OSHA Definition*

Pressure Demand Respirator: A positive pressure atmosphere- supplying respirator that admits breathing air to the facepiece when the positive pressure is reduced inside the facepiece by inhalation. *OSHA Definition*

Protection Factors: *NIOSH Definition*

Assigned Protection Factor (APF): The minimum anticipated protection provided by a properly functioning respirator or class of respirators to a given percentage of properly fitted and trained users.

Simulated Workplace Protection Factor (SWPF): A surrogate measure of the workplace protection provided by a respirator.

Workplace Protection Factor (WPF): A measure of the protection provided in the workplace by a properly functioning respirator when correctly worn and used.

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

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

Recommended Exposure Limit (REL): An 8- or 10-hour time-weighted average (TWA) or ceiling (C) exposure concentration recommended by NIOSH that is based on an evaluation of the health effects data. *NIOSH Definition*

Respiratory Inlet Covering: The 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 facepiece, a helmet, a hood, a suit, or a mouthpiece respirator with nose clamp. *OSHA Definition*

Self-Contained Breathing Apparatus (SCBA): An atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user. *OSHA Definition*

Service Life: The length of time required for an air-purifying element to reach a specific effluent concentration. Service life is determined by the type of substance being removed, the concentration of the substance, the ambient temperature, the specific element being tested (cartridge or canister), the flow rate resistance, and the selected breakthrough value. The service life for a self-contained breathing apparatus (SCBA) is the period of time, as determined by the NIOSH certification tests, in which adequate breathing gas is supplied. *NIOSH Definition*

Service Life: The period of time that a respirator, filter or sorbent, or other respiratory equipment provides adequate protection to the wearer. *OSHA Definition*

Single-Use Dust or Dust and Mist Respirators: Respirators approved for use against dusts or mists that may cause pneumoconiosis and fibrosis. *NIOSH Definition*

Supplied-Air Respirator (SAR) or Airline Respirator: An atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user. *OSHA Definition*

This Section: This respiratory protection standard. *OSHA Definition*

Tight-Fitting Facepiece: A respiratory inlet covering that forms a complete seal with the face. *OSHA Definition*

User Seal Check: An action conducted by the respirator user to determine if the respirator is properly seated to the face. *OSHA Definition*

Vapor: The gaseous state of a substance that is solid or liquid at temperatures and pressures normally encountered. *NIOSH Definition*