Respirator Primer:
Tools for successful program management

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Course objectives

At completion of course

- Demonstrate knowledge of respirator program elements
- Apply practical approaches to protect workers from inhalation hazards
- Identify sources and tools for specific program needs
- Share program challenges and solutions

Agenda

- Introduction
- Respiratory Protection Program Elements
- Class Exercise

Introductions

- Currently managing respiratory protection program?
- Who wears a respirator?
- Responsibility for reviewing the program?
- Just for fun?

Why respiratory protection?

- Inhalation is an effective route of exposure
- Respirators prevent
  - Systemic toxicity
  - Damage to the respiratory tract

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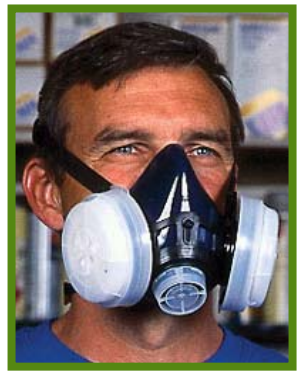
OR-OSHA 1910.134

- Requires employer to develop and implement a written respirator program
  - With required worksite-specific procedures
- Must be implemented by a “suitably trained” program administrator with *appropriate accountability and responsibility* to manage the program

Respirator program elements

- Program Administrator
- Hazard Assessment
- Selection
- Medical Evaluation
- Fit Testing
- Use, Care & Maintenance Procedures
- Training
- Program Evaluation
- Recordkeeping
- Special Considerations (air quality)



Hazard assessment

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OR-OSHA requirements

- **1910.134(d)(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.

Hazard assessment

- Where do you start?
  - Facility walk-through
  - Interviews
  - Process flow-chart and/or list of processes
  - List of chemicals and MSDS from Hazard Communication Program
- Don’t forget
  - Maintenance Tasks
  - Emergencies
- Must be updated when changes are made

Assessment: What to look for

Insufficient oxygen

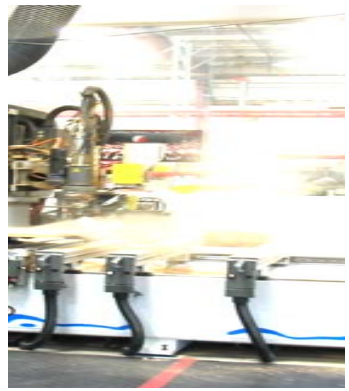
- Tanks
- Pits
- Large tools/ equipment
- Confined areas where inert/cryogenic gases are released
- Other confined spaces

Assessment: What to look for

- Hazardous vapors or gases

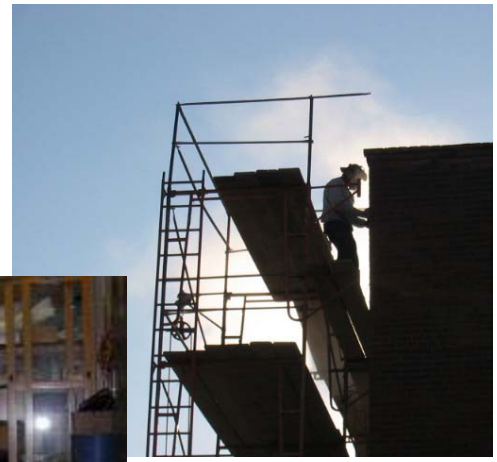
Assessment: What to look for

- Dust, mists, fumes, sprays and other airborne particles



Assessment: What to look for

- Short-term, non-routine, or emergency tasks which produce gases, vapors, dusts, fumes or particles



Assessment: Quantification

- IH Monitoring data, or
- Objective data

Location	Process	MSDS	Controls	Frequency Duration	Monitoring Done? Date	Contaminant	Results	PEL	Respirator
Bldg 1 Fab Bay	MIG welding on mild Steel with bare wire AWS ER70S-6	#365 & #499	None	Daily 8 hours	Yes 3/6/07	Total welding fume Iron oxide	12 mg/m³ 10 mg/m³ (TWA)	10 10	N95 Dust Mask
Bldg 1 Fab Bay	Pneumatic Grinding on mild steel	#365	None	Daily 15 min	Yes 3/6/07	Total Particulate	5 mg/m³ 0.2 TWA	10	N96 Dust Mask
Bldg 1 Paint Booth	Mixing and spraying enamel paint	#199, 200, 256, 275, 501	Spray Booth	Occasional 3 hours	No	Toluene, Xylene, MEK, Titanium Dioxide	6 ppm 15 ppm 3 ppm 1 mg/m³	100 100 200 10	½ Face APR With OV Cartridge and prefilter
Bldg 4 Maintenance	Parts Cleaner	#35	Enclosed and ventilated	8 x per day 10 min/use	No	Stoddard Solvent		200 ppm	None

Considerations

- Chemical properties (e.g. vapor pressure, boiling point, decomposition temperature, flammability limits)
- Quantity
- Toxicity
- Occupational Exposure Limits (OR-OSHA PEL, ACGIH TLV™, NIOSH REL) 8-hr, STEL, and Ceiling
- Other regulatory requirements (mandatory monitoring)
- How chemical is used (e.g. is it heated, sprayed, wiped on)
- Frequency/duration
- Controls

Monitoring is required by substance specific standards

- Asbestos
- Lead
- Chromium VI
- Arsenic
- Cadmium
- Benzene
- Methylene Chloride
- Ethylene Oxide
- Formaldehyde
- Cotton Dust
- Vinyl Chloride
- Methylenedianiline
- Coke Oven Emissions
- Acrylonitrile
- 1,2-dibromo-3-chloropropane
- 1,3-Butadiene

Where to get help

- In house expertise or association
- Workers' compensation insurance carrier
- OR-OSHA consultation
- Private consultants

Hierarchy of controls

- Engineering Controls
- Administrative Controls
- Personal Protective Equipment
  - This includes respirators

Hierarchy of controls

Some reasons respirators are the least desirable control:

- Provide protection only if fitted and worn correctly and consistently used
- Protect only the employees wearing respirators
- Are uncomfortable, cumbersome, and interfere with communication - all which can decrease workplace safety
- Substantial costs to operate program (consider medical examinations, fit testing, training, and the purchasing of equipment)

Voluntary use if respirators aren't required

- "When it's **not necessary** for employees to use respirators, they can use them **voluntarily**, provided you permit them to do so and their health or safety isn't affected."
- What does this mean?
  - Must be medically able
  - Must be provided with information in 1910.134, Appendix D.
- If respirators are NOT required and **only** dust masks are used, provide Appendix D
- See OR-OSHA Fact Sheet on Voluntary Use of Respirators

Selection

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Selection

- Is oxygen content adequate?
- What are the expected exposure concentrations?
  - Supplied air or air-purifying (protection factor needed?)
  - Full-face or half-face respirator?
- Is the chemical a particulate? Gas? Mist? Fume?
- Are cartridges available?
  - When do you replace cartridges?
  - Warning properties…
- Process/Environment/Work Requirements

How do you choose?

Selection

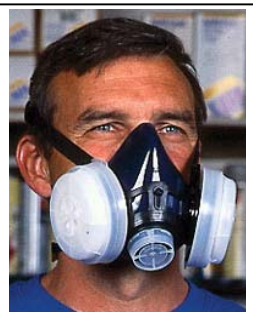
- Other consideration
  - Beards
  - Mobility
  - Temperature/humidity
  - Worker limitation
  - Worker preferences
- Use NIOSH-certified respirators.

Types

Air Purifying

- Filtering facepiece

- Elastomeric



- Powered air-purifying (PAPR)

- Escape

Supplied-air (SAR)

- Air-line

- Self-contained breathing Apparatus (SCBA)

Air-purifying respirators

Particulates

N – not resistant to oil
R - Somewhat resistant to oil
P – Strongly Resistant to oil

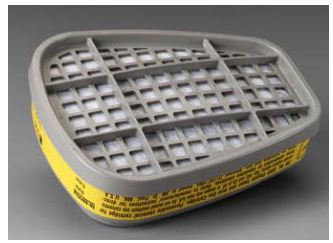
95 – Filters at least 95% of airborne particulates
99 – Filters at least 99% of airborne particles
100 – Filters at least 99.9% of airborne particles

N95 – lowest level of protection
P100 – highest level of protection

Air-purifying respirators

Vapor / Gas Cartridges - color coded

Type of air contaminant	Cartridge color code
Organic vapors	Black
Acid gases Sulfur dioxide (SO2) Chlorine (C12) Hydrogen chloride (HCl)	White
Organic vapors & acid gases	Yellow
Ammonia (NH3) & methylamine	Green
Dusts & mists only	Gray
Dusts, mists, & fumes (high efficiency)	Magenta/Purple
Formaldehyde	Chartreuse (greenish mustard)



CHECK THE LABEL!

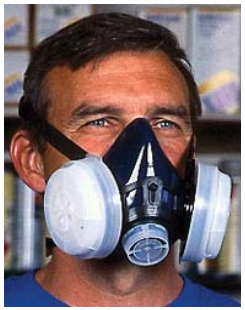
Air-purifying respirators

Combination

Organic vapors + particulate (P100)

Organic vapors + ammonia + acid gas

Assigned Protection Factors (APF)



APF = 10

APF = 25

APF = 50

APF = 1000

Assigned Protection Factors

Type of respirator[1, 2]	Quarter mask	Half mask	Full facepiece	Helmet/ hood	Loose-fitting facepiece
1. Air-Purifying Respirator	5	[3]10	50	.....	.....
2. Powered Air-Purifying Respirator (PAPR)	.....	50	1,000	[4]25/1,000	25
3. Supplied-Air Respirator (SAR) or Airline Respirator					
• Demand mode	.....	10	50	.....	.....
• Continuous flow mode	.....	50	1,000	[4]25/1,000	25
• Pressure-demand or other positive-pressure mode	.....	50	1,000	.....	.....
4. Self-Contained Breathing Apparatus (SCBA)					
• Demand mode	.....	10	50	50	.....
• Pressure-demand or other positive-pressure mode (e.g., open/closed circuit)	.....	.....	10,000	10,000	.....

Assigned Protection Factor

$$\text{APF required} = \frac{\text{Exposure Concentration}}{\text{Permissible Exposure Limit (PEL)}}$$

Non-allergenic Wood Dust

- Exposure Concentration is 90 mg/m^3
- OR-OSHA PEL is 10 mg/m^3
- What APF is required?

Toluene

- Exposure Concentration is 300 ppm
- OR-OSHA PEL is 100 ppm
- Is a ½ mask organic cartridge respirator adequate?

Cartridge change schedule

Respiratory protection service life

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OSHA Requirement 1910.134(d)(3)(iii)(B)(2)

- Develop cartridge/canister change schedules based on available data or information.
- Reliance on **odor thresholds** and other warning properties will not be permitted as the primary basis for determining the service life of gas and vapor cartridges and canisters.
- Recommend a **conservative** approach when evaluating service life testing data.
- Recommend employers apply a **safety factor** to the service life estimate to assure that the change schedule is a conservative estimate.

Definitions

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

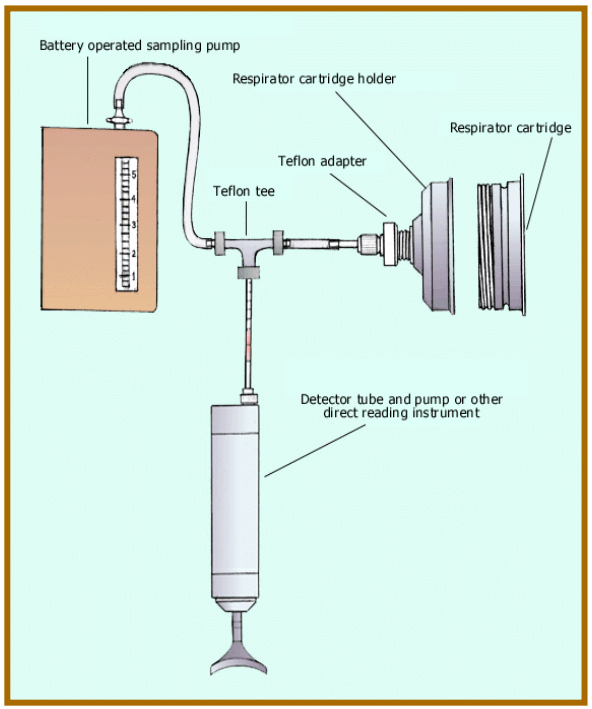
Factor affecting service life

- **Exertion level of work (the work rate or breathing rate)**
- **Cartridge Variability**
- **Temperature**
- **Relative Humidity**
- **Multiple Contaminants**

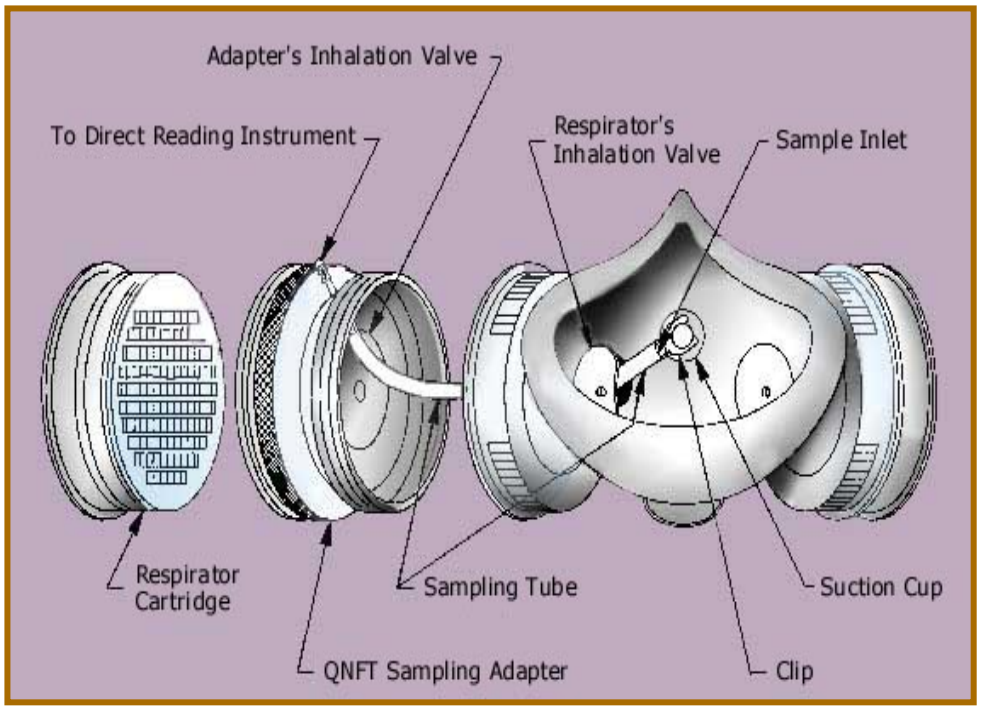
3 ways to estimate service life

ONE Conduct Experimental Tests

Test 1:



Test 2:



3 ways to estimate service life

Two **Use a Math Model**

- The Wood Math Model Table – One contaminant model
- The Yoon-Nelson Mathetical Model

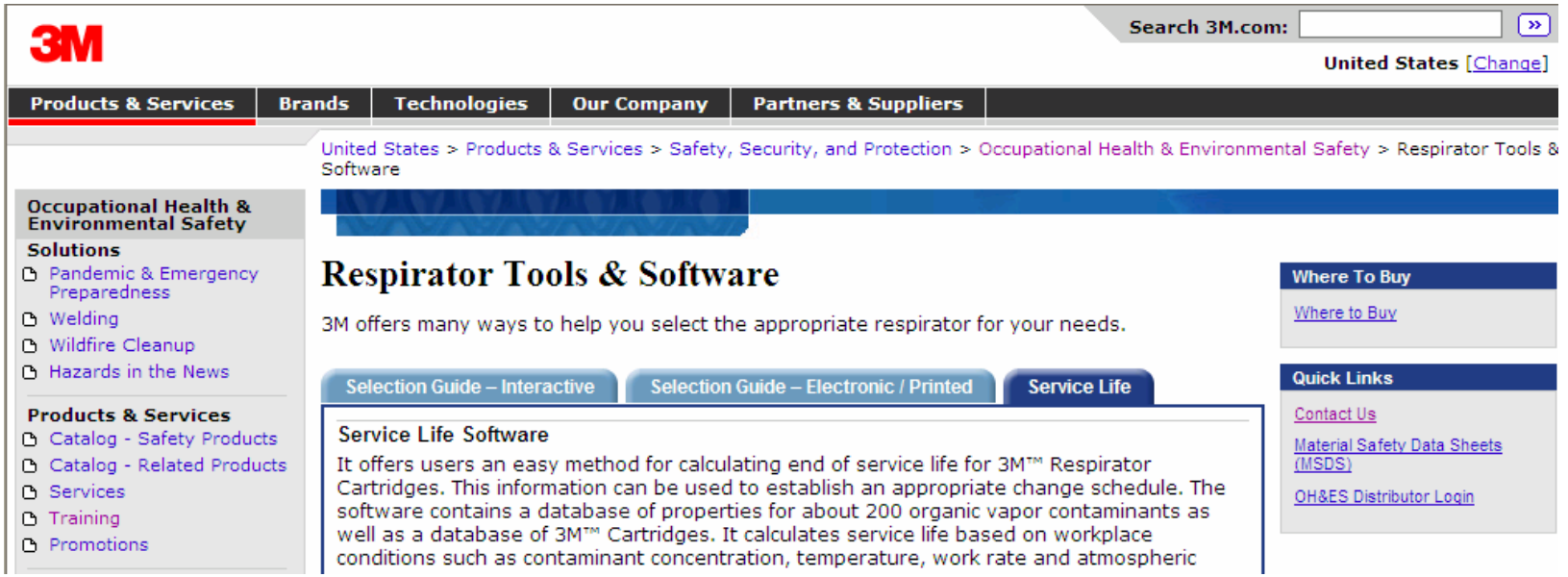
3 ways to estimate service life

Three Use Manufacturer's Recommendations

- Obtain the following information to provide manufacturer or use in available software tool
  - Names of airborne contaminants
  - Concentrations of those contaminants (in parts per million)
  - Humidity in work area
  - Temperature
  - Work rate
  - Name/type of respirator

Manufacturer Sites software/tools

3M **http://solutions.3m.com/wps/portal/3M/en_US/Health/Safety/Resources/Four/**



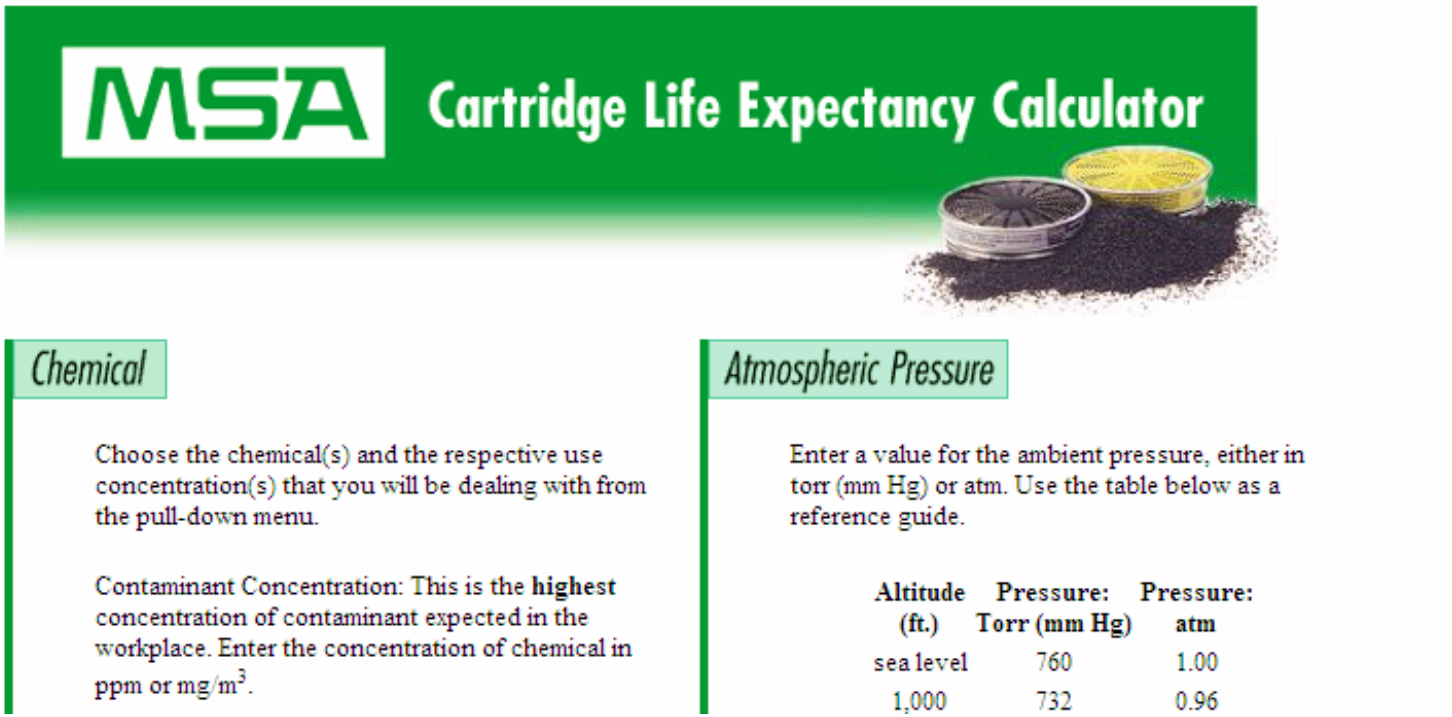
Manufacturer Sites software/tools

North Safety Products

http://www.northsafety.com

Manufacturer Sites software/tools

MSA **http://webapps.msanet.com/cartlife/msa.htm**



Medical evaluation

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Medical evaluation procedures

- If respirators are **required** you must do medical evaluations
- Before fit-testing occurs
- Physician or Licensed Health Care Professional (PLHCP)
- Questionnaire (confidential) or a physical examination
  - Appendix C - Questionnaire
  - Follow-up medical if yes to any question 1-8 in Part A, Section 2, or as a result of physical examination

Employer information for PLHCP

- Written respiratory protection program
- Type and weight of respirator
- Duration and frequency of use
- Expected physical work effort
- Other PPE and equipment to be worn
- Temperature and humidity extremes
- Copy of OR-OSHA Respiratory Protection Program, Medical Evaluation

Medical evaluation

- Obtain PLHCP written medical determination for records
- Additional medical evaluations
  - Employee reports medical problems with respirator use
  - When PLHCP, supervisor, or program administrator determines need
  - Observation during fit-testing and program evaluation indicates need
  - Change in workplace condition (e.g., physical work effort, PPE, temperature) that increases physiological burden

Fit-testing

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Fit-testing

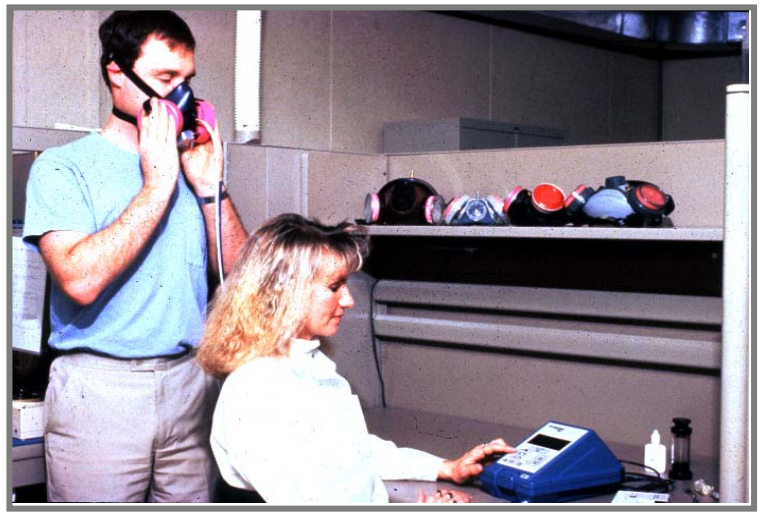
- Annual fit-testing necessary for of all employees required to wear “tight-fitting” facepieces
- Qualitative fit testing (QLFT) or Quantitative fit-testing (QNFT) are allowed except when:
  - Used in an environment with greater than 10 times the PEL
  - With a respirator that is negative pressure (or has that potential)
- Appendix A of OR-OSHA 1910.134 details fit testing protocols

Fit-testing - Qualitative

- Non-numeric method that relies on the wearer's response to a test agent to determine respirator fit
- Test agents
  - Banana oil (Isoamyl acetate)
  - Saccharin
  - Bitrex
  - Irritant smoke

Fit-testing - Quantitative

- Numeric assessment of how well the respirator fits
- Three methods for quantitative instruments
  - Controlled Negative Pressure (CNP)
  - Ambient Aerosol or Condensation Nuclei Counting (CNC)
  - Generated Aerosol/Booth Systems



Acceptable fit testing methods

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

Taken from OSHA's Small Entity Compliance Guide for the Revised Respirator Protection Standard

Respirator seal check

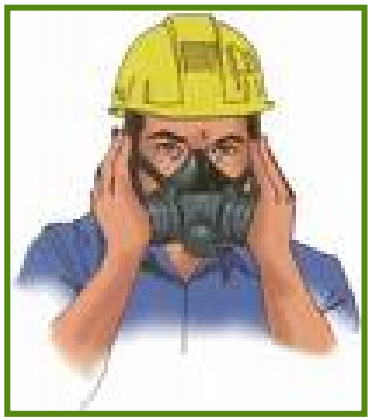
- Completed by wearer of negative pressure respirators prior to fit test and each use
  - Demonstrates knowledge
  - Verifies that respirator has sealing surface
- Must include both negative and positive seal checks

- or -

manufacturer recommendation

that provides equivalent protection

Respirator seal check



Negative pressure – Cover the inlet, gently inhale and hold for 10 seconds (listen and feel for leaks)

Positive pressure - Cover the exhalation valve and exhale respirator should hold pressure for a few seconds (listen and feel for leaks)

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Resources for medical evaluation and fit-testing

- Medical Evaluation
  - Occupational Medicine Providers and Clinics
- Fit Testing
  - Occupational Medicine Providers and Clinics
  - Occupational Safety and Health Consultants
  - Respirator and Safety Equipment Vendors
  - You

Current sources of information on providers include the web and your workers' compensation carriers

Quantitative fit-testing demonstration

Brian Williams

Industrial Hygienist

AMEC Earth & Environmental, Inc.

7376 SW Durham Road

Portland, Oregon 97224

503.639.3400

Courtesy of TSI Incorporated

Use, care, and maintenance

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Use requirements

- Preventing leaks across the seal
  - No facial hair across the sealing surface
  - Consistent seal checks prior to use
- Ensuring that:
  - employees do not remove respirators in hazardous environment
  - Respirators function as intended
- Protect employees entering IDLH atmospheres and during structural firefighting

Maintenance and care

- Cleaning and disinfecting
  - Exclusive use
  - Shared use
- Ensure that respirators are stored to protect from damage and contamination.
- Ensure that routinely used respirators are inspected before use and during cleaning. Inspect emergency use respirators at least monthly.
- Repairs must include the same part by the same manufacturer

Training

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Training

- To be done prior to respirator use.
- Must be understandable.
- Includes employee demonstration of core knowledge.
- Training resources:
  - OSHA website
  - Instructional videos
  - Manufacture’s use instructions

Training topics

- Why respirator is necessary
- Proper fit, usage and maintenance.
- Limitations and capabilities.
- Emergency situations.
- How to inspect, put on, remove use, check seals, maintain and store.
- How to recognize medical signs and symptoms

Retraining

Required:

- Annually
- When conditions or requirements change
- When employee's knowledge or use of respirator indicate the need

Program evaluation, recordkeeping, and special considerations

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Program evaluation

- Evaluate workplace to ensure the written program is properly implemented.
- Consult employees to ensure they are using respirators properly
- Verify appropriate respirator selection
- Frequency of evaluation is dependant on program maturity and complexity

Recordkeeping

- Written program
- Hazard assessments
- Medical evaluations.
- Fit-testing
- Training
- Program evaluation

Special considerations: air quality

Ensure air quality in atmosphere-supplying respirators

- Grade D quality
- Cylinders
- Compressors
  - Carbon monoxide or over temperature alarms

Resources

- CD Contents
- Visit CROETweb at www.croetweb.com
- Federal OSHA http://www.osha.gov/SLTC/etools/respiratory/index.html
- State OSHA http://www.osha.oregon.gov/subjects/respiratory_protection.html
- Manufacturer websites

Group Exercise

- If not listed assume it is not in place
- Scenario
  - Wood dust
  - Welding
  - Painting
  - Chemical drum changes

Acknowledgement

Life Safety Corporation 1221 SE Gideon Street Portland, Oregon 97202

503-231-8282 fax 503-231-8383 toll free 1-800-335-7809

Thank you to Life Safety Corporation for allowing the use of their respirators


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