Managing a Respiratory Protection Program

Guidance for occupational medicine professionals

National Jewish Health
Respiratory Protection Program
Outline of Our Talk

• Overview of a comprehensive respiratory protection program – Lata Shirname-More, PhD, Business Manager

• Respiratory Protection in the Health Care setting and Medical clearances - Annyce Mayer, MD, MSPH – Medical Director, Medical Surveillance Program

• Nuts and Bolts of a Respiratory Protection Program– Amy Ridder, BS, Respiratory Protection Program Coordinator

• Q & A

• Demonstration of a Qualitative Fit Test – Amy Ridder
Respiratory hazards and health effects

- Respiratory hazards include:
  - dusts
  - fumes, gases, mists, vapors & smoke
  - infectious agents

- Health effects include:
  - Airway injury
  - Airway disease: asthma & COPD
  - Pneumoconiosis
  - Asphyxia
  - Inhalational fever
  - Hypersensitivity pneumonitis
  - Infections
  - Toxic effect due to systemic absorption
  - Cancer
Respiratory Protection Standard

OSHA 29 CFR 1910.134

The Occupational Safety and Health Administration (OSHA) has established a standard to control those occupational diseases caused by breathing air contaminants with harmful dusts, fogs, fumes, mists, sprays and vapors

The Standard also covers Respiratory Protection for airborne transmission of Tuberculosis

The primary objective is to eliminate or prevent exposures to these airborne contaminants
Develop your written respiratory protection program

OSHA Regulations (29 CFR 1910.134) requires a written respiratory protection program with the following elements:

- Procedure for selecting respirators
- Medical Evaluation for respirator use
- Fit testing
- Procedures for respirator use
- Procedures/schedule for storing, cleaning, inspection of respirators
- Training
- Program Evaluation
Implementing a proper Respiratory Protection Program is critical

• From a compliance perspective respiratory protection violations continues to be on the 10 OSHA violation list.

• OSHA estimates 5 million workers are required to wear respirators in 1.3 million workplaces throughout the US.
Key Steps to Implementing a Respiratory Protection Program

– Eliminate the Need for Respiratory Protection
  • *Use as a last resort*

– Invest the Time to Become Knowledgeable About Respirators
  • *Program should be administered by a knowledgeable person*

– Seek Help of Outside Experts
  • *When you lack the expertise or resources*

– Implement Your Written Respiratory Protection Program
  • *After respiratory hazard is evaluated and the right respirators are selected*

– Establish a Process to Keep Your Program Effective
  • *Ensure that it is up to date and effective*
**Respiratory Protection is the Control of Last Resort**

<table>
<thead>
<tr>
<th>NIOSH Hierarchy of Controls:</th>
<th>Respirator should be used:</th>
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</thead>
<tbody>
<tr>
<td>1. Elimination</td>
<td>• while the controls are being instituted</td>
</tr>
<tr>
<td>2. Substitution</td>
<td>• when controls are not feasible</td>
</tr>
<tr>
<td>3. Engineering controls</td>
<td>• when controls are not sufficient to reduce respiratory hazards to a level below established exposure limits</td>
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<tr>
<td>4. Administrative controls</td>
<td>• when unpredictable or uncontrolled exposures are possible</td>
</tr>
<tr>
<td>5. Respiratory protection</td>
<td>• during emergency situations</td>
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</table>
Mandatory versus Voluntary Use of Respirators

Are Respirators:
• necessary to protect the health of the employee; or
• required by the employer?

Must establish & implement a written respirator program with worksite-specific procedures

Does the employer permit voluntary use of respirators?

Does the only use of respirators involve the voluntary use of filtering face pieces (dust masks)?

• Employer determines that the respirator itself does not create a hazard
  • Must provide users with information contained in Appendix D.
  • No respirator program required

• Employer determines that the respirator itself does not create a hazard
  • Must provide users with information contained in Appendix D
  • Must establish & implement those elements of a written respirator program necessary to ensure that employee is medically able to use that respirator.

Selection of respiratory protection for healthcare workers

- Maintains sterile field
- Protects mucous membranes of wearer
  - Bloodborne pathogens
  - Infectious droplets
- Droplet precautions

- Respirator
  - NIOSH approved
  - Selection optimized by fit testing

- Airborne precautions

Surgical mask

N-95 respirator
Respiratory Infectious Disease Transmission

- Contact
- Droplet
  - Droplets $\geq$ 5 microns
    - Drop quickly from the air
    - Surgical mask within 3 feet of the patient
- Airborne
  - Droplet nuclei < 5 microns
    - Small particle aerosols
  - Respirator inside the room

For every infectious agent, established:
- Route(s) of transmission
- Protection needed

Centers for Disease Control (CDC)
Respiratory Protection for TB

- Airborne transmission
- Respirator required
  - N-95 (minimum)
- Covered under 1910.134
  - Since 2003
  - Annual fit testing
  - Enforced since 2009
Respiratory Protection for Influenza

- 2009
  - CDC/NIOSH recommended N95 respirator

- 2010
  - CDC/NIOSH recommended surgical mask

- No difference in surgical mask vs. N95 respirator for preventing influenza among health care workers (Loeb, 2008)
Infectious particles can change

- Infectious agent
- Initial size of particle

- Final size of particle
  - initial size of particle
  - size of organism
  - rate of physical decay

- Settling velocity
  - particle size
  - airflow

- Viability of agent
  - inherent characteristics
  - rate of biologic decay

Final Particle Determines Outcome

Penetration through face seal and filter
Deposition in the respiratory tract

Grinshpun SA J Occ Env Hyg 2009; Lee SA Ann Occup Hyg 2008,
Is Airborne Transmission Possible?

• Cough produces highly variable size particles, including those <1-5 microns (Yang, 2007) (Tang, 2008)

• Respirable size particles from coughing patients contains Influenza A RNA <1 &<5 microns (Lindsley, 2010)

• Influenza RNA in particles of respirable size in air in medical facilities <1 &<5 microns (Lindsley, 2010) (Blachere 2009)

• Animal models demonstrate airborne transmission of H1N1 & some other strains (Munster, 2009) (Mubareka, 2009)

• Airborne transmission suggested on aircraft with ventilation failure (Moser MR Am J Epi 1979)
Consider Higher Level of Protection

- In the setting of uncertainty
- High risk infections
- Aerosol-generating procedures
Medical Clearance for Respirator Use

• Initial medical clearance required
  – Mandatory questionnaire*
    • Positive responses trigger follow up evaluation
      – No standardized protocol
    – Equivalent evaluation by PLHCP

• No follow up medical evaluation
  – Except when:
    – employee reports signs/symptoms with respirator use
    – recommendation the employee should be evaluated
    – indication based on fit testing or program evaluation
    – change in the workplace that will increase the physiologic burden

* Appendix C to 1910.134
Physiologic Burden

• Physical demands of the work
• Frequency and duration of use
• Environmental stressors
• Other PPE
• Type of respirator
Medical Considerations

- Fit for duty without respirator ≈ Fit for duty with respirator

- Anxiety/claustrophobia most common limiting factor
  - Trial PAPR

- Respiratory
  - Tight fitting filtering respirators increase work of breathing
  - Most can use respirator at least to moderate workloads (Martyny, 2002) (Hodous 1986) (Hodous 1983)

- Cardiovascular
  - High work loads, particularly with SCBA

- Musculoskeletal conditions

- Skin conditions

- High risk environment (IDLH)
  - Sudden incapacitation, anosmia
Respirator Facts

- All respirators leak!!!
  - Seal and positive pressure make the difference.
  - Protection factor matters
- Respirator cartridges fill up!!!
- Many chemicals are untested!!!

Protection depends upon training and use
Respirator Categories

- **Air Purifying**
  - ½ Face (elastomeric)
  - Full Face
  - PAPR (powered air purifying respirator)
  - Filtering Face Piece Respirators (disposable)

- **Supplied Air**
  - SCBA
  - Airline
OSHA Permissible Exposure Limits (PELs) and Assigned Protection Factors (APF)

**PEL**: The maximum amount or concentration of a chemical that a worker may be exposed to in any 8-hr work shift of a 40-hr work week

**AFP**: Based on the minimum expected workplace level of protection by a properly functioning respirator or class of respirators.

<table>
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<tr>
<th>Respirator</th>
<th>APF</th>
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<tbody>
<tr>
<td>Disposable</td>
<td>10</td>
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<tr>
<td>Elastomeric</td>
<td>10</td>
</tr>
<tr>
<td>Full Face</td>
<td>10 (QLFT) 50 (QNFT)</td>
</tr>
<tr>
<td>PAPR</td>
<td>25-1000</td>
</tr>
<tr>
<td>Air-Line</td>
<td>25-1000</td>
</tr>
<tr>
<td>SCBA</td>
<td>10,000</td>
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</table>
Filtering Face Pieces

- Commonly referred to as N95
- Filters 95% particles at 0.3 microns
- <10 X PEL
- Useful life < 8 hours
- No eye protection

**Advantages**
- Lightweight
- Disposable

**Disadvantages**
- More difficult to obtain good seal
- Limited to particulate protection
Elastomeric & Full Face

**Half Face**
- Advantages
  - Mobility
  - Replaceable cartridges
- Disadvantages
  - No eye protection
  - Limited cartridge life
  - Protection Factor <10XPEL
  - CANNOT be used in low O₂ environments

**Full Face**
- Advantages
  - Mobility
  - Replaceable cartridges
  - Respiratory and eye protection
  - Protection Factor <50X PEL (QNFT)
- Disadvantages
  - Limited cartridge life
  - CANNOT be used in low O₂ environments
Powered Air Purifying Respirators (PAPR)

Tight Fitting

• Advantages
  – Higher level of protection than loose fitting PAPR (1,000x PEL)
  – Air blown on face helps keep wearer cool

• Disadvantages
  – Airflow is critical
  – Heat stress
  – Maintenance-battery life
  – Cost
  – CANNOT be used in low O2 environments
Powered Air Purifying Respirators (PAPR)

Loose Fitting

• Advantages
  – Beards may be worn
  – Air blowing over face keeps wearer cool

• Disadvantages
  – Lower protection factor than tight fitting PAPR (25x PEL)
  – Airflow is extremely critical
  – Heat Stress
  – Maintenance – Battery life
  – Cost
  – CANNOT be used in low O2 environments
Cartridges/Filters

- HEPA Filters
- Organic Vapor (solvents)
- Ammonia & Methylamine
- Acid Gas
- Mercury
- Formaldehyde
- Combination or multi-gas

NIOSH Color Coded
Limitations of Canisters and Filters

- Chemical specific
- No Service life indicator available
- Cannot be used in low oxygen (<19.5%) environments
- Cannot use in IDLH conditions
- Filters cannot be cleaned and reused
Atmospheric Supplied Respirators

**SCBA**

- **Advantages:**
  - Provides highest level of respiratory protection
    - Unknown environments
    - Low O₂ environments
    - IDLH environment
  - Disadvantages:
    - Heavy ~ 35 lbs.
    - Bulky
    - Limited air supply (~30 minutes)
    - High maintenance/cost

**Air Line Respirators**

- **Advantages**
  - High level of respiratory protection
  - Not limited to air tank supply
  - Can be worn in low O₂ environments
- **Disadvantages**
  - Must drag airline behind
  - Not practical for most emergency response situations
Procedures/schedule for storing, cleaning, inspection of respirators

• You are required to provide each respirator user with a respirator that is clean, sanitary, and in good working order

• At a minimum, all maintenance programs are required to include information about:
  – Cleaning and disinfecting procedures
  – Proper storage
  – Inspections for defects before each use and during cleaning of a respirator
  – Repair methods
You are prohibited from using a tight-fitting respirator if you have the following:

• Missing dentures

• Facial scars, jewelry that interferes with the face piece seal

• Facial hair
Respirator Fit Testing

Determine how effectively respirator seals to users face

How Often?
Minimum of once/year or:

• Facial Changes
• Significant weight change
• Change of respirator size, make, model

Other Requirements:
• 8 exercises
• 1 minute/exercise
• Documentation
Qualitative Respirator Fit Testing

Based on Sense of Smell or Taste

- Taste (Bitrex or Saccharin)
- Smell (banana oil)
- Irritant smoke (stannic chloride)
- Only provides an Assigned Protection Factor of 10X PEL
NJH Fit Device

• High-volume qualitative fit testing
• Fit Test 6 people at one time
• Use standard fit test nebulizers
• Ideal for hospital settings
Fit Testing - Quantitative

**TSI PortaCount**

Compares concentration of dust particles outside respirator to concentration of particles in respirator
Fit Testing Comparison

**Quantitative**
- Advantages
  - Most accurate method
  - Higher APF for full face respirators
  - Subject cannot lie
- Disadvantages
  - Cost
  - Not practical for disposable respirators

**Qualitative**
- Advantages
  - Inexpensive
  - Logical choice for filtering face respirator fit testing
- Disadvantages
  - False negative (subject)
  - Accuracy
  - Hard to verify
Training

Employees who are required to use respirators must be trained annually such that they can demonstrate knowledge of at least:

- Proper fit, use, maintenance
- Limitations and capabilities
- Effective use in emergency situations
- How to inspect, don/doff, use, user seal checks
- Maintenance and storage
- Recognition of medical signs and symptoms that may limit or prevent effective use
- General requirements of standard

Must conduct Program Evaluation as necessary
OSHA Citations – Low Hanging Fruit

- Respirator Storage
- Annual Fit Testing
- Annual Training
- Documentation
- Facial Hair
Questions???

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