An Overview of Hearing and Noise Protection

By Joseph Lyons

Airgas
Hearing Protection

• Hearing loss is one of the most pervasive occupational health problems in America today.
• Approximately 30 million workers are exposed on their jobs to noise levels or toxicants that are potentially hazardous to their hearing. Fortunately, noise-induced hearing loss can be reduced, or often eliminated, through the successful application of occupational hearing loss prevention programs.
Impact of Noise Damage

- Tinnitus
- Hearing Loss
- Injuries on the job
Tinnitus

- Tinnitus is a ringing, hissing or booming sensation in your ears.
- Excessive exposure to noise increases the risk of tinnitus. If the noise is impulsive (e.g. blasting), the risk can rise substantially.
- Tinnitus can be the first sign that your hearing has been damaged by noise.
Hearing Loss

• Noise-induced hearing loss (NIHL) is a common occupational disease in America.
• NIHL is usually caused by prolonged exposure to loud noise. The first symptom is normally the inability to hear high-pitched sounds. Unless the problem of excessive noise is addressed, a person’s hearing will deteriorate further, including difficulties detecting lower-pitched sounds. This will normally occur in both ears.
• The damage of noise-induced hearing loss is permanent.
• Hearing loss can occur without long-term exposures. Brief exposure to impulsive noises (even a single strong impulse), such as from gunshots or nail or rivet guns can have permanent effects,
Work Place Injuries

Noise can lead to accidents by:

• Making it harder for workers to hear and correctly understand speech and signals.
• Masking the sound of approaching danger or warning signals (e.g. reversing signals on vehicles)
• Distracting workers, such as drivers.
• Contributing to work-related stress that increases the cognitive load, increasing the likelihood of errors.
1910.95

- OSHA sets legal limits on *noise exposure* in the workplace. These limits are based on a worker's time weighted average over an 8 hour day.
- An 8-hour time-weighted average of 85 decibels or a dose of fifty percent shall also be referred to as the *action level*.
Permissible Noise Levels

- **160 dB**: Immediate physical damage! Jet taking off (140 dB)
- **130 dB**: Immediate pain threshold
  - Jackhammer (130 dB)
  - Firecrackers (125 dB)
  - Rock concert (120 dB)
- **115 dB**: Risk of HEARING DAMAGE in 15 minutes
  - Snowmobile riding (110 dB)
- **105 dB**: Risk of HEARING DAMAGE in 1 hour
  - Headphones (100 dB) - same as a chainsaw!
  - Motorcycle (95 dB)
- **95 dB**: Risk of HEARING DAMAGE in 4 hours
  - Lawnmower, truck traffic (90 dB)
- **85 dB**: OSHA hearing protection regulations start here
- **75 dB**: “Non-hazardous” noise
  - Dog barking (70 dB)
  - Normal conversation (50-60 dB)
- **50 dB**: Comfortable sound
A Noise Reduction Program

- Analyze/study workplace
  - Dosimeter, ISM

- Design Program
  - Exposure, Engineering, Administrative

- Implement Program
  - Change schedules
  - Maintenance equipment
  - Provide PPE

- Document results and compliance
  - JUST IN CASE
Qualitative vs. Quantitative

OSHA’s two approved methods for fit testing.

• Qualitative
  o A qualitative fit test is a pass/fail test that relies on the employee's response to a test agent. The OSHA protocols include saccharin, isoamyl acetate (banana oil), Bitrex and irritant smoke.

• Quantitative
  o A quantitative fit test measures the adequacy of a respirator's fit by numerically measuring the amount of leakage into the respirator. The OSHA protocols include use of a PortaCount, CNC or CNP test.
Types of PPE

- Disposable Foam Plugs
- Push-in Foam Plugs
- Premolded Reusable Plugs
- Banded Earplugs
- Earmuffs
Noise Reduction Rating
NRR

• The NRR is a single number rating system representing the average noise reduction, in decibels, that a hearing protection device might provide if worn properly.
• All Hearing PPE should provide a NRR rating.
• Subtract NRR from average dBA to get under 90.
• Prepare “cushion”, people will not wear properly.
Respiratory Protection

- The primary objective of the **respiratory protection** program is to prevent exposure to air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, vapors, or sprays, and thus to prevent occupational illness.

<table>
<thead>
<tr>
<th>CONTAMINANT/APPLICATION</th>
<th>POTENTIAL HEALTH EFFECTS FROM OVER EXPOSURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel/Manganese Alloys</td>
<td>Pneumoconiosis, Siderosis, Central Nervous System effects</td>
</tr>
<tr>
<td>Stainless Steel</td>
<td>Pneumoconiosis, kidney effects, lung irritation, cancer</td>
</tr>
<tr>
<td>Aluminum</td>
<td>Respiratory irritation (due to ozone)</td>
</tr>
<tr>
<td>Galvanized Steel</td>
<td>Metal Fume Fever</td>
</tr>
<tr>
<td>Cadmium</td>
<td>Metal Fume Fever, respiratory irritation, lung cancer, kidney effects</td>
</tr>
<tr>
<td>Lead</td>
<td>Central Nervous System effects, systemic poisoning</td>
</tr>
<tr>
<td>Ozone</td>
<td>Respiratory irritation, lung congestion, bronchitis, headache, dry throat</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>Anoxia, Central Nervous System effects</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>Asphyxiation</td>
</tr>
<tr>
<td>Phosgene</td>
<td>Respiratory irritation, anoxia, pulmonary edema</td>
</tr>
<tr>
<td>Oxides of Nitrogen</td>
<td>Respiratory irritation and edema</td>
</tr>
</tbody>
</table>
1910.134

- **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

- **1910.134(a)(2)** A respirator shall be provided to each employee when such equipment is necessary to protect the health of such 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. The program shall cover each employee required by this section to use a respirator.
Respiratory Hazards

- **Dusts**
  - Caused by Sanding, Grinding, Cutting, and Sweeping of various materials.

- **Fumes**
  - Caused when metal is heated.

- **Mists**
  - Tiny droplets formed from spraying liquid materials. Ex. Paint Booth

- **Gases**
  - Airborne and invisible at room temperatures. Ex. CO, NH3, Freon

- **Vapors**
  - Formed when solid or liquids become a gas. Ex. Solvents, Paint Thinner, Gasoline
Respiratory Protection Program

• Step 1- Exposure Assessment
• Step 2 Written Respiratory Program
• Step 3 Respirator Selection
• Step 4 Medical Evaluation
• Step 5 Fit Testing
• Step 6 Respirator Training
# N95s and Such

What the letters and numbers mean.

## Filter classifications, efficiencies, oil resistances and challenge agents specified under 42 CFR part 84

<table>
<thead>
<tr>
<th>42 CFR part 84</th>
<th>Oil Resistance Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Efficiency</td>
<td>N Non-oil Aerosols</td>
</tr>
<tr>
<td>95%</td>
<td>N95</td>
</tr>
<tr>
<td>99%</td>
<td>N99</td>
</tr>
<tr>
<td>99.97%</td>
<td>N100</td>
</tr>
</tbody>
</table>

*May have a time use restriction on this filter series when oil aerosols are present.

**Use according to manufacture’s time use restrictions when oil aerosols are present.
Assigned Protection Values

- **Assigned Protection Factor** (APF) is the workplace level of respiratory protection that a respirator or class of respirators is expected to provide to employees when the employer implements effective respiratory protection program.

<table>
<thead>
<tr>
<th>RPD type in US</th>
<th>APF in US[22]</th>
</tr>
</thead>
<tbody>
<tr>
<td>N95 negative pressure air-purifying half mask respirators (filtering facepieces or elastomeric)</td>
<td>10</td>
</tr>
<tr>
<td>N99 or N100 negative pressure air-purifying half mask respirators (filtering facepieces or elastomeric)</td>
<td>10</td>
</tr>
<tr>
<td>Negative pressure air-purifying respirators with full facepieces with P100 filters</td>
<td>50</td>
</tr>
<tr>
<td>Powered Air-Purifying Respirators (PAPRs) with loose-fitting hood or helmet, and P100 filters</td>
<td>25</td>
</tr>
<tr>
<td>Supplied Air Respirators (SARs) or Self Contained Breathing Apparatus (SCBA) with full mask and air supply on demand</td>
<td>50</td>
</tr>
<tr>
<td>SARs with full mask and pressure demand air supply</td>
<td>1 000</td>
</tr>
<tr>
<td>SCBA with full mask and pressure demand air supply</td>
<td>10 000</td>
</tr>
</tbody>
</table>
What to look for

Example of Exterior Markings:
Approval holder business name, a registered trademark manufacturer business name or an easily understood abbreviation. If privately labeled, the private label name or logo is here instead of the approval holder business name.

TC #XXX-XXXX – TC-approval number
Model # XXXX – Model number
Lot # XXXX – Lot number (recommended)
NIOSH – NIOSH name in block letters or a NIOSH logo
Filter Designation – NIOSH filter series Alpha-numerical rating followed by filter efficiency level (ex. P100, N95)

EXTERIOR VIEW
## What to use

<table>
<thead>
<tr>
<th></th>
<th>Dusts</th>
<th>Fumes</th>
<th>Mists</th>
<th>Gases</th>
<th>Vapors</th>
<th>IDLH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particulate Filter</td>
<td><img src="image1" alt="Particulate Filter" /></td>
<td><img src="image2" alt="Fumes" /></td>
<td><img src="image3" alt="Mists" /></td>
<td><img src="image4" alt="Gases" /></td>
<td><img src="image5" alt="Vapors" /></td>
<td><img src="image6" alt="IDLH" /></td>
</tr>
<tr>
<td>Supplied Air</td>
<td><img src="image7" alt="Supplied Air" /></td>
<td><img src="image8" alt="Fumes" /></td>
<td><img src="image9" alt="Mists" /></td>
<td><img src="image10" alt="Gases" /></td>
<td><img src="image11" alt="Vapors" /></td>
<td><img src="image12" alt="IDLH" /></td>
</tr>
</tbody>
</table>

*Image descriptions: Particulate Filter, Fumes, Mists, Gases, Vapors, IDLH.*
## Disposable vs Reusable

<table>
<thead>
<tr>
<th>Types of Respirators and Selected Features</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Disposable Respirators</strong></td>
</tr>
<tr>
<td>- Comfort</td>
</tr>
<tr>
<td>- Lightweight composition</td>
</tr>
<tr>
<td>- Adjustable straps (available on select models)</td>
</tr>
<tr>
<td>- Overall economy</td>
</tr>
<tr>
<td>![Disposable Respirator Image]</td>
</tr>
<tr>
<td><strong>Reusable Respirators</strong></td>
</tr>
<tr>
<td>- Designed to be reusable — replace cartridges and filters at the end of their service life</td>
</tr>
<tr>
<td>- Filter and/or cartridges are available for many applications</td>
</tr>
<tr>
<td>- Many styles also can be adapted to a PAPR or Supplied Air Respirator</td>
</tr>
<tr>
<td>![Reusable Respirator Image]</td>
</tr>
</tbody>
</table>

![Diagram of Disposable Respirator Features]  ![Diagram of Reusable Respirator Features]
## Respirator Cartridge Color Coding

<table>
<thead>
<tr>
<th>Cartridge Color</th>
<th>Cartridge Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>Organic Vapors (OV)</td>
</tr>
<tr>
<td>White</td>
<td>Acid Gas (AG)</td>
</tr>
<tr>
<td>Yellow</td>
<td>Organic Vapors/Acid Gases (OV/AG)</td>
</tr>
<tr>
<td>Green</td>
<td>Ammonia/Methylamine (AM/MA)</td>
</tr>
<tr>
<td>Brown</td>
<td>Organic Vapors/Acid Gases/Ammonia (OV/AG/AM)</td>
</tr>
<tr>
<td>Olive</td>
<td>Other Vapors and Gases or combinations not listed above (ie. Multi-Gas)</td>
</tr>
</tbody>
</table>
Secret Word?
For a Training Certificate

• Go to:

  • https://www.surveymonkey.com/r/8CXY2QB