RESPIRATORY SELECTION FOR AIRBORNE INFECTIOUS AGENTS

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OSHA's Respiratory Protection Standard

29 CFR 1910.134

Requirements for Using Respirators

1. Conduct a Risk Assessment
2. Respirator selection
3. Written RPP; Assign Program Administrator
4. Medical evaluation
5. Training
6. Fit testing
7. Maintenance
8. Program evaluation
9. Maintain records

Risk Assessment

- Conducting a risk assessment to determine the proper respirator to use for chemicals is a rather straight forward exercise.

  – Determine potential exposures to respiratory hazards

  – Measure the breathing zone concentration of the hazards

  – Select the type of respirator needed to protect the worker

Risk Assessment

- Selecting the respirator can easily be done in this scenario by
  - Calculating the hazard ratio
  - Selecting a respirator with a APF greater than the hazard ratio

C. Calculate hazard ratio

- For chemicals & dusts, a hazard ratio (HR) can be helpful to determine the type of respirator to be used. This can only be used if there exists an OSHA permissible exposure level (PEL)

- Determining the HR:
  - What is airborne concentration?
  - What is the PEL, TLV* or REL*?
  - HR = Concentration / PEL

  TLV=threshold limit value, REL=recommended exposure level

Hazard ratio examples

One pint of formaldehyde solution spilled in a room 20' x 20' x 8' = 3,500 ppm

- PEL 0.75 ppm TWA **HR=4667**

One pint of ethanol spilled in the same room = 2,200 ppm

- PEL 1,000 ppm TWA **HR=2.2**

OSHA's APFs

- Filtering face piece (N95) = 10
- Half face APR = 10
- Full face APR = 50
- Loose fitting PAPR = 25/1000*
- Full face pressure demand SAR = 2000
- SCBA pressure demand = 10,000

* If documentation is provided by the manufacturer as to their determination of the APF

Airborne Infectious Agents

- The information on APF and Hazard Ratio work great for those agents that are easily measured and have a well defined exposure limit.

- Airborne infectious agents are not easily measured and have no defined limit of exposure
  - Remember when dealing with some infectious agents only one infectious particle is needed to cause an infection.

Airborne Infectious Agents

- The is limited information on amount of infectious particles expelled by a patient based upon

  - patient activities (coughing, sneezing)
  - the nature of the infectious agent – the effect that humidty and drying has on the expelled particle

Exposure Reduction

- Exposure reduction is a term we used to explain the protection afforded by a type of respirator for an airborne infectious agents which have no exposure limit and cannot be easily quantified, a respirator can be selected based on exposure reduction and risk of infection

- Exposure reduction of a respiratory is a combination of the filter efficiency & APF

Risk of Infection

- Different infectious agents pose differing potential for infection based upon the ability of the particle to survey outside the host and the infectivity of the agent.
  - Viruses tend to be more infectious than bacteria
- Risk of infection for the worker is determine by the evaluating the infectivity of the agent, the ventilation of the area, the time exposed, and the exposure reduction afforded by the respiratory protection selected.

Risk of Infection

- The information on airborne infectious agents is fairly limited and is based on data collected during epidemics.
- The data is only available for a limited number of agents however the information available can be generalized for bacterial agents and viral agents.

Risk of infection
Viral Agent – Measles

Respirator	Probability(%/hr)	Risk
None	29%	1/3.5
N-95	7%	1/24
PAPR(APF 25)	1%	1/100
PAPR (APF 1000)	<1%	<1/100

Based on a patient in an isolation room with 6 air exchanges per hour (ACH) and 93 quanta of infectious particles released per hour (Riley EC 1978)

Risk of Infection
Bacterial agent (laryngeal TB)

Respirator	probability(%/hr)	risk
None	19%	1/5
N-95	5%	1/20
PAPR(APF 25)	<1%	<1/100
PAPR (APF 1000)	<1%	<1/100

Based on a patient in an isolation room with 6 air exchanges per hour (ACH) and 60 Quanta of infectious particles released per hour (Cantanzaro 1982)

Summary

- Even though there may not be exposure limits for airborne infectious agents using the information on exposure reduction, the quanta of infectious particles released, and the effectiveness of engineering controls a decision can be made on the appropriate respiratory protection to be used to protect workers and reduce the probability and risk of infection.

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- Thank You

- QUESTIONS ?