Agenda

➢ Common Allergens
➢ Occupational Asthma
➢ Regulations and Allergies
➢ Allergen Assessment
➢ Risk Management
➢ Prevention
**Current State**

- Allergies are major contributors to the total cost of health-related absenteeism and presenteeism.
- Up to 15% of all asthma cases are of occupational origin or have at least a significant causal occupational factor.
- Occupational Asthma (OA) is an important industrial disease because it is not uncommon, is moderately disabling and is costly at both individual and societal levels.
Common Allergens

AGRICULTURE
pollen, microbes, storage mites, animal materials
(dander, hair, saliva, urine)

LABORATORY
rodent urinary allergens

FOOD
dried mushrooms, soy bean, wheat flour

INDUSTRIAL/COMMERCIAL
Chemicals, Isocyanates
Inhalative irritants: chlorine, acid/ alkaline aerosols
Low molecular weight chemicals
What is Occupational Asthma?

Occupational asthma (OA) is a form of lung disease in which the breathing passages shrink, swell, or become inflamed or congested as a result of exposure to irritants in the workplace.

Contact Trigger
Body starts to make IgE
IgE grabs the allergen
Histamine and chemicals are released to blood stream
Symptoms occur
Allergens in the Lungs

Relative Size Chart of Common Air Contaminants (Shown in micrometres)

- Tobacco Smoke
- Yeast Cells
- Oil Smokes
- Mold
- FOG
- Mists
- Rain
- Nonsettling Atmospheric Imp.
- Settling Atmospheric Imp.
- Heavy Industrial Dust
- Fumes
- Dusts
- Fly Ash
- Visible by Human Eye
- Electron Microscope
- Microscope
- X-Rays
- Ultra-Violet
- Visible
- Infra-Red

Superior Airways of Respiration
- Coarse particles: Dp < 10 μm

Inferior Airways of Respiration
- Fine particles: Dp < 2.5 μm
- Inhospitable particle: Dp < 1 μm
- Alveoli
- Ultrafine particles: Dp < 100 nm
Common Allergy Symptoms

Respiratory
- Sinusitis
- Coughing
- Wheezing and difficulty breathing
- Headaches
- Fatigue
- Chronic or perennial rhinitis
- Allergic Asthma

Skin
- Dermatitis (eczema)
- Hives
- Itching

Eyes
- Itching
- Burning
- Swelling
- Watering
Asthma Today

- 3,615 deaths/year
- 7.8% of the population has asthma
- In 2008 caused 14.2 million missed days of work
- More than 9 people die of asthma every day
- 1 in 12 adults had asthma in 2010
- Costs $56 billion/year
- Morbidity 10.3/million

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Challenges to Combat OA

• Little evidence of sustained, successful prevention of the disease
• Disease is conceptually fragmented
• Low industrial and public profile
• Relatively uncommon within a single workplace
Economic Impact

- Around 10% of adult asthma is attributable to occupational factors.
- Asthma remains the most commonly reported occupations lung disease in most industrialized countries.
- Costs >$1.6 billion.
Common Biological Allergens

- Animals
  - Cat (*Fel d I* >10 - <2 µm diameter)
- Dust mites (~20 µm diameter)
- Mold
- Pollen
- Bee Stings
- Cockroach
- Rodents
- Peanuts
Chemical Allergens

- >3,000 chemical agents associated with allergic dermatitis
- >65,000 chemicals may produce skin irritation
- >200 chemicals and biologic agents reported to produce allergic sensitization resulting in asthma
  - toluene diisocyanate (TDI) and other isocyanates
  - platinum salts
  - animal antigens
  - anhydrides
  - wood dusts
  - rubber latex
  - acrylates and detergent enzymes
Chemical Allergy

• Immune-mediated adverse health effects caused by exposures to chemicals
• Among the most common immunological manifestation and represent a significant occupational health hazard
• Inhalation and Dermal contact are primary routes of exposure
• Immune responses are complicated and based on multiple factors
  – Nature of the allergen
  – Exposure scenario (route, duration, frequency and magnitude)
  – Individual susceptibility
Chemical Allergy

• Allergic respiratory diseases are associated with high levels of worker morbidity. An estimated 10-25% of all cases of adult asthma are associated with occupational factors (2015) equivalent to an incidence of new-onset occupational asthma of 250-300 cases per million annually
Common Chemical Allergen Sources

• Latex gloves
• Beauty Products
• Cleaning Supplies
• Metals
• Fragrance (Sensitivity)

Dear Axe Body Spray,

Please put a suggested serving size on your bottles.

Sincerely,
Choking girls everywhere.
Allergic Sensitization

• Traditionally viewed as the result of high exposures related to spills or similar events
• Other factors may include:
  – Cumulative exposures
  – Poor working conditions
  – Type of industrial process
  – Atopy
  – Cigarette smoking
  – Genetic influences
  – Geographic location
• Once sensitized, the exposure dose to set off asthmatic symptoms may be much lower than the initial dose necessary to create the condition
• Example:
  – TDI exposures in the area of 0.02 ppm may sensitize a worker
  – Once sensitized concentrations of TDI of 0.005 ppm or less may cause reaction
Isocyanates

• Isocyanates react with compounds containing alcohol (hydroxyl) groups to produce polyurethane polymers
  – Components of polyurethane foams
  – Thermoplastic elastomers
  – Spandex fibers
  – Polyurethane paints. Isocyanates are the raw materials that make up all polyurethane products

• Impacted occupational hazards
  – Painting
  – Foam-blowing
  – Manufacture of Polyurethane products (chemicals, polyurethane foam, insulation materials, surface coatings, car seats, furniture, foam mattresses, under-carpet padding, packaging materials, shoes, laminated fabrics, polyurethane rubber, and adhesives, and during the thermal degradation of polyurethane products)

• Health effects
  – Irritation of skin and mucous membranes
  – Chest tightness
  – Difficult breathing
  – Isocyanates include compounds classified as potential human carcinogens and known to cause cancer in animals
  – Occupational asthma and other lung problems
Low Molecular Weight Compounds-Acid Anhydrides

- Reactive chemicals used widely in alkyd and epoxy resins
- Major hazards
  - Irritation of skin and mucous membranes
  - Sensitization of the respiratory tract
- Occupational uses, often in small spaces
  - Adhesives
  - Casting
  - Coatings
  - Sealants
  - Printing Inks
  - Fabric Treatment

Source: IHS
OSHA and Workplace Allergens

- General Duty Clause Section 5(a)(1)
- 1910 Subpart I, Personal protective equipment
  - 1910.132 General requirements
  - 1910.134 Respiratory protection
  - 1910.138 Hand protection
- 1910 Subpart Z, Toxic and hazardous substances
  - 1910.1048, Formaldehyde
    - Appendix C, Medical surveillance-formaldehyde
- 1910.1030, Bloodborne pathogens
Chemical Allergens with TLVs

- Beryllium and compounds
- Flour dust
- Hexahydrophthalic anhydride
- Hexamethylene diisocyanate
- Isophorone diisocyanate
- Maleic anhydride
- Methylene bisphenyl isocyanate
- Methylene bis(4-cyclohexylisocyanate)
- Natural rubber latex
- Piperazine
- Toluene diisocyanate (TDI)
- Trimellitic anhydride
## Hazard Notations for Chemical Allergens

<table>
<thead>
<tr>
<th>Organization</th>
<th>Designation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>GHS</td>
<td>Hazard Statement 317 Skin sensitizer Hazard Statement 334</td>
<td>May cause allergic skin reaction Causes skin sensitization May cause allergy or asthma</td>
</tr>
<tr>
<td>ACGIH</td>
<td>SEN RSEN DSEN</td>
<td>Potential for agent to produce sensitization Respiratory sensitization Dermal sensitization</td>
</tr>
<tr>
<td>CAL/OSHA</td>
<td>“D”SEN “R”SEN</td>
<td>Can cause occupation dermal responses Can cause respiratory sensitization</td>
</tr>
<tr>
<td>NIOSH</td>
<td>SEN</td>
<td>Potential for immune-mediated reactions following exposures to the skin</td>
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Challenges for Establishing OELs

- Characterization of dose-response relationship
- Effects of peak exposure
- Individual susceptibility
- Exposure route (dermal vs respiratory tract)
- Potentially more than one route of exposure
- Characterizing workplace exposures
- Sensitive populations
Allergen Assessment

- Is there an allergen risk
- Is the allergen a chemical
- Exposure levels/pathways/physical forms
- Control strategies
- Communication strategies
Assessment

• Verified exposure–response relationships provide the basis for risk assessment
• If no reliable data on the health risk of an occupational allergen exist, the lowest reasonably practicable exposure level should be attempted
• What preventive measures can be initiated in workplaces with elevated allergens
• Targeted interventions to reduce the incidence of occupational asthma with consideration of cost-benefit
Work History

• CDC/ASTR Work History Form

• An occupational exposures database
  www.aoecdata.org/Default.aspx

• Safety data sheet
Sampling

• Does the allergen have a sampling method?
• Are there current guidelines for acceptable levels?
• Unregulated chemicals in particulate form can be assessed
  – OSHA Particulates Not Otherwise Regulated (PNOR), total and respirable dust 15 mg/m³ and 5 mg/m³
  – ACGIH particulates not otherwise classified (PNOC) TLV 3 mg/m³ respirable dust, 10 mg/m³ inhalable dust
Risk Management Guidance

Most desirable

Substitution

Engineering

Administration

PPE

Least desirable
Risk Management

- **Substitution**: Replace chemical allergen with alternative non-allergenic option

- **Engineering**:  
  - Process Design
  - Isolation
  - Ventilation

- **Administration**:  
  - Work-practice
  - Medical monitoring
  - Exposure monitoring

- **PPE**: PPE Program
Prevention

Primary Prevention

- Pre-employment selection
- Pre-product screening
- Controlling exposures

Secondary Prevention

- Regular medical surveillance (spirometry, skin prick)
- Improved hygiene measures
- Questionnaire
What Is Affecting Prevention?

**Societal**
- Frequency
- Nature of the disease
- Perception
- Costs

**Technical**
- Strength of evidence
- ID of risk factors
- Availability of Prevention Methods

**Business**
- Frequency
- Impact on customers
- Public reputation
- Costs
- Influence of employee or customer organizations
Summary

- Allergen assessments can be challenging
- Clients are often emotional
- Other factors impact workplace exposure
- Prevention is the key
References

• Economic impact of workplace productivity losses due to allergic rhinitis compared with select medical conditions in the United States from an employer perspective, Charles E. Lamb, Paul H. Ratner, Clarion E. Johnson, Ambarish J. Ambegaonkar, Ashish V. Josh. http://dx.doi.org/10.1185/030079906X112552
• H. M. Sandler. Regulating Allergies in the Workplace, Oct 01, 2000
Contact:

Michelle McIntyre, MPH, CIH, CSP
mmcintyre@teamgfa.com
239-489-2443