

Summary of Health Effects

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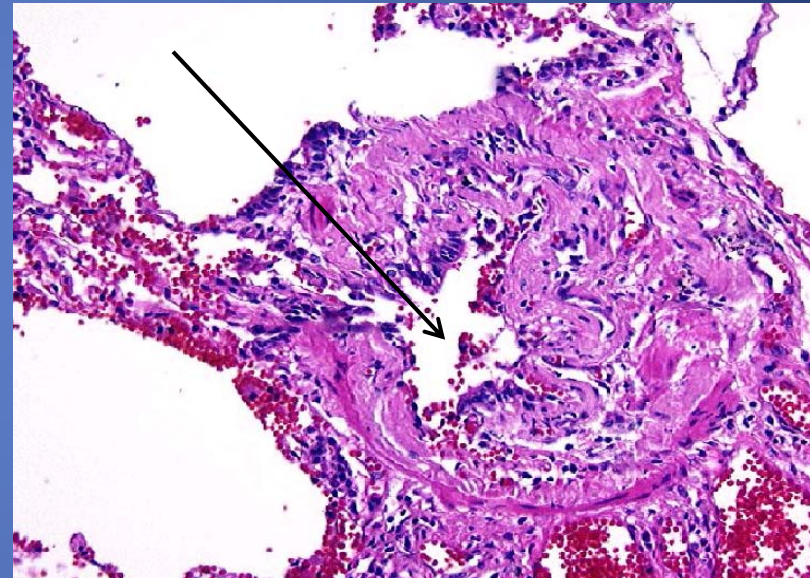
Division of Respiratory Disease Studies

Types of Health Effects

- Obstructive lung disease
- Restrictive pulmonary functions
- Rapid lung function decline
- Asthma
- Mucous membrane irritation
- Dermatitis

Constrictive Bronchiolitis Obliterans (Obstructive Lung Disease)

- Rare, irreversible
- Scarring of bronchioles
- Air trapped in air sacs
- Difficulty blowing air out
- Medical treatment unsuccessful



Microwave Popcorn Workers: Index Plant

- 8 former workers in index plant with severe disease, 4 on lung transplant lists, 4 mixers
- 25% current workers had abnormal breathing tests (3.3-fold excess obstruction)
- Cumulative diacetyl exposure associated with breathing test abnormalities and measurements

Index Plant Follow-up

- Among initial survey participants, chest symptoms persisted and only mucous membrane irritation improved
- New hires had better respiratory health on average and stayed healthy
- High average annual declines in breathing tests became normal in the initial participants who participated in all 8 surveys.

Five Other Microwave Popcorn Plants

- 4 plants had workers with clinical bronchiolitis obliterans
- Mixers had higher prevalences of respiratory symptoms and lower breathing test measurements
- Packaging workers in plants where mixing was not isolated had more symptoms and obstruction

Flavor Manufacturing Plants

- 1985: 2 definite cases in a plant manufacturing flavorings for baking industry
- Mid-1990s: 5 cases in flavoring plant
- 2004-6: 2 cases in two CA flavoring plants resulted in industry-wide surveillance
- Severe and very severe obstruction was 2.7 times higher than expected; 15 times higher in those less than 40 years.

Risk Factors in California

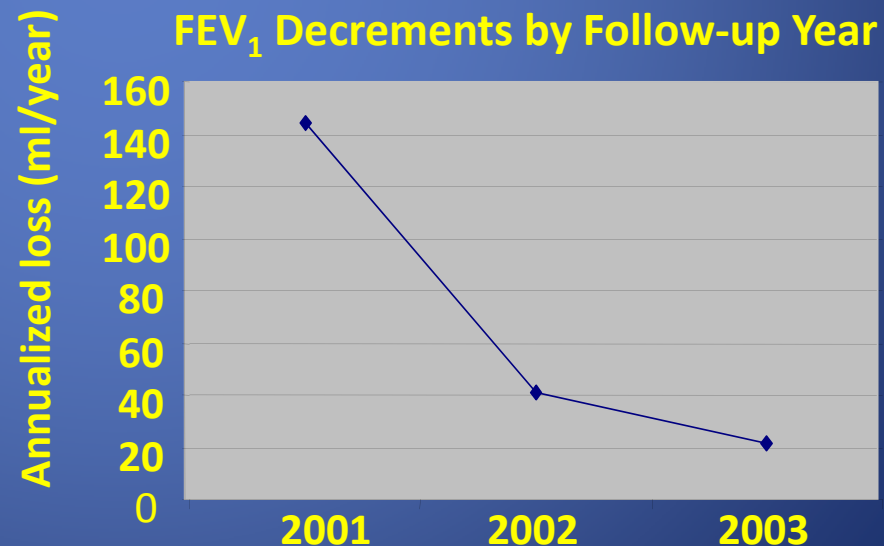
- 16 cases from 4 companies using ≥ 800 lbs/yr
- 16 cases had worked in production
- Tenure associated with degree of obstruction
- Chest symptoms present in half
- Abnormal FEV1 declines associated with companies using ≥ 800 lbs/yr and with 4-person clusters of obstruction
- Only 1/21 had obstruction

Restrictive Lung Function

- 28% flavoring production workers in one plant have restrictive abnormalities (3.8 X expected)
- 19% had excessive decline in FEV1
- Workers with higher potential flavorings exposure had 7.0-fold odds of abnormal decline of FEV1

Rapid Lung Function Decline

- Excessive FEV1 declines in serial spirometry occurs in workers with normal, obstructive, and restrictive spirometry
- Many cases of >1 liter declines in 4-5 months
- Many cases of severe impairment within <1-2 years
- Control of exposure normalized average annualized FEV1 decline.



Asthma

- Reversible airflow limitation
- Physician-diagnosed asthma twice expected rate in two microwave popcorn plants
- Asthmatics can become worse around irritants and asthma can be caused by sensitizers
- 3/3 workers popping popcorn and adding flavorings developed asthma

Mucous Membrane/Skin Effects

- Eye and nasal irritation decreased from 65% to 33% at index plant
- Three plants had severe eye irritation in relation to particular butter flavorings
- Disabling contact dermatitis with abnormal patch tests to all butter flavorings in the plant
- Post-hire skin problems as high as 60% in liquid flavor producers.

Criteria for Causal Associations

- Exposure precedes disease development
- Strength of association
- Replication of findings (consistency)
- Dose-response relationship
- Biologic plausibility
- Consideration of other explanations