

# TerranearPMC Safety Share

## Week of September 24, 2012 – Popcorn Workers Lung

This past week a legal decision resulted in a suburban Denver man being awarded \$7.2 million based on his medical diagnosis of "popcorn lung." This is a disease that has only been recently recognized as being attributed to the chemical, diacetyl; a substance used to provide a buttery flavor to such products as popcorn. The association between diacetyl and popcorn lung has been typically noted as an occupational exposure. However, the prosecuting attorney argued that his client's medical condition was brought on by his inhaling the artificial butter smell of the microwave popcorn he regularly ate. The basis of his argument was that the various food companies that manufactured/used the chemical diacetyl for the purpose of providing that buttery taste failed to warn consumers that inhaling the buttery aroma could put them at risk of lung injury. Meanwhile, defense attorneys had argued the Denver man's health problems stemmed not from popcorn but from his years of working with carpet-cleaning chemicals.

Popcorn lung disease is a rare and irreversible illness. The formal name of this disease is bronchiolitis obliterans, and, in the past, has been frequently misdiagnosed by physicians as asthma, bronchitis, or emphysema. Because this disease is irreversible (cannot be repaired), severe cases often require a lung transplant. It is important to catch this disease in its earliest stages. This is typically performed through spirometry (pulmonary function test).

Bronchiolitis obliterans is derived from the Latin words, bronchiolitis, meaning inflammation of the bronchioles and *obliterans* referring to the fact that the inflammation or fibrosis (loss of elasticity) of the bronchioles partially or completely obliterates the airways. It may also be referred to as *constrictive bronchiolitis*. It is a rare fixed obstructive lung disease where granulation tissue, or scar tissue, gradually obstructs the bronchioles, or airways.

While one may make the assumption that diacetyl is strictly a manufactured chemical, it is naturally occurring and is found in butter, cheese and wine. Unfortunately, this once-seemingly harmless ingredient in microwave popcorn has caused serious illness in several popcorn factory workers, and in 2007, at least one consumer. The first documented cases occurred in Jasper, Missouri in 2000 at the Gilster-Mary Lee plant where eight workers were diagnosed with popcorn lung. These workers had been exposed to diacetyl for an extended period of time while they were testing bags of microwave popcorn. The National Institute for Occupational Safety and Health (NIOSH) conducted a study of 117 popcorn factory workers and found that they suffered higher rates of airway obstruction, chronic cough, shortness of breath, throat irritation, tightness in the chest and wheezing than what is found normally in the general population.

The chemical name for diacetyl is 2,3-butanedione meaning (for all you chemistry enthusiasts) it is a four-carbon, straight chain molecule with each of the two middle carbons having a double-bonded oxygen.

Because diacetyl is a Food and Drug Administration (FDA)-approved chemical for use as a flavoring, there were originally few precautions in place to protect workers from adverse effects. Since 2000, NIOSH has advised for implementation of safety measures for handling diacetyl in order to prevent future cases of popcorn lung. Although the Flavor and Extract Manufacturers Association has assured consumers that there is virtually no risk of developing popcorn lung from eating buttered popcorn, it has been recommended that manufacturers reduce the use of this chemical, mostly to protect plant workers. In 2007, ConAgra, the largest

US popcorn manufacturer of brands such as Act II and Orville Redenbacher, joined other manufacturers in replacing the flavoring.

One can understand how workers may be exposed to elevated airborne concentrations of diacetyl as they are working with this material every day, for an entire shift, 40 hours every week, which has been going on for years. Yet, we now see consumers affected by an over-exposure. As was brought out in a previous consumer lawsuit, the consumer indicated that he developed popcorn lung due to his above average consumption of microwave popcorn. Over a ten year period, he ate two bags of buttered popcorn every night, inhaling the bags as they came out hot from the microwave.

In addition to diacetyl, there are other substances and conditions that have been associated with the development of bronchiolitis obliterans. These include collagen vascular disease, transplant rejection in organ transplant patients, viral infection (respiratory syncytial virus, adenovirus, HIV, cytomegalovirus), Stevens-Johnson Syndrome, Pneumocystis pneumonia, drug reaction, aspiration and complications of prematurity (bronchopulmonary dysplasia), and exposure to toxic fumes, including: sulfur dioxide, nitrogen dioxide, ammonia, chlorine, thionyl chloride, methyl isocyanate, hydrogen fluoride, hydrogen bromide, hydrogen chloride, hydrogen sulfide, phosgene, polyamide-amine dyes, mustard gas and ozone. It can also be present in patients with rheumatoid arthritis. Certain orally administered emergency medications, such as activated charcoal, have been known to cause it when aspirated. Additionally, the disorder may be idiopathic, meaning "without known cause."

Although OSHA has not published an occupational exposure limit for possible inhalation exposures of diacetyl, the American Conference of Governmental Industrial Hygienists has adopted a very stringent threshold limit value of 0.01 parts per million (ppm) as a time-weighted average during a 40-hour work week with a short-term exposure limit of 0.02 ppm which is designed to protect workers for 15-minute exposure periods.

Bronchiolitis obliterans is indicated by a significantly reduced lung capacity, shortness of breath, wheezing and a dry cough. Diagnosis may include the following tests:

- Chest X-rays tests.
- Diffusing capacity of the lung (DLCO) tests are usually normal.
- Spirometry tests show fixed airway obstructions and sometimes restriction (FEV1/FVC ratio being <70%).
- Lung volume tests may show hyperinflation (excessive air in lungs caused by air trapping).
- High-resolution computerized tomography scans of the chest at full inspiration and expiration may reveal heterogeneous air trapping on the expiratory view as well as haziness and thickened airway walls.
- Lung biopsies may reveal evidence of constrictive bronchiolitis obliterans (i.e., severe narrowing or complete obstruction of the small airways). An open lung biopsy, such as by thoracoscopy, is more likely to be diagnostic than a transbronchial biopsy. Special processing, staining, and review of multiple tissue sections may be necessary for a diagnosis

The symptoms can start gradually, or severe symptoms can occur suddenly. So do yourself a favor next time at the movies; get the jujubes!

**Thunder is good, thunder is impressive; but it is lightning that does the work.**

Mark Twain